VHF HORIZONS

OCTOBER 1962
40 CENTS

ANTENNAS

50 Mc to 10 kMc

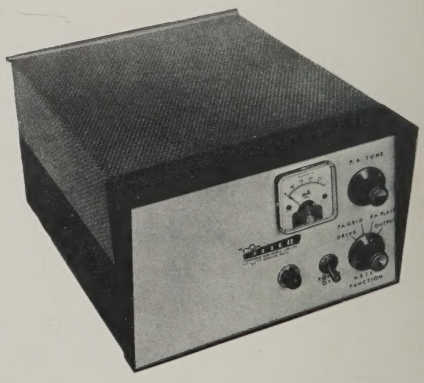
Amateur Radio Above 50 Megacycles

CLIMBING TO INFINITY...

SAM HARRIS (W1FZJ) NEVER LOOKS DOWN!

It is because of this fact that TELco is progressing so far, so fast . . . . so steadily. Sam is our Chief Engineer, and it is his guidance that enables TELco to produce the ultimate in VHF - UHF - SHF spectrums.

SAM HARRIS, W1FZJ-W1BU
Design Engineer in Parametrics, Varactor Harmonic Generation, Solid States, and a Pioneer in Moonbounce.



FLIP THE SWITCH . . . and you're on 6 . . . It's here at last . . . the TELco SB-50 6 meter Heterodyne Transmitting Converter is absolutely the finest way to get on 6. It takes the output of your 20 meter gear (AM, CW, or SSB) and gives you 30 watts output on 6. It has a powerful 6146 final, requires only 5-10 watts of drive, is stable as a rock, and a cinch to tune. Available from stock immediately, so rush your check now.

NOW ONLY **$85.00**
POSTPAID TO YOUR DOOR

Write Now for Catalog of TELco Products Designed for the Technician.

TELCO

TAPETONE ELECTRONICS LABORATORIES, INC.

99 Elm Street — West Newton 65, Mass.

From the Publisher's Shack

A TRIBUTE TO AN ERA

By now many will have learned that the original nationwide VHF newsheet for the amateur (VHF Amateur) is no more.

It is with a great deal of sadness that we mark its passing. Young Editor-Publisher Bob Brown (K2ZSQ) is personally known to many of you through on-the-air contact and his frequent appearances at amateur radio conventions and gatherings, especially along the east coast. For nearly five years Brown filled a void . . . a very deep void. He cranked out monthly issues of VHF Amateur keeping so many of us informed of what each other was doing during a period when the current mushrooming interest in VHF/UHF was only in its infancy. Often without adequate finances, Bob plugged along convinced that he was doing a job that needed doing and apparently certain that someday his *efforts* would be recognized.

Well . . . *they were.* Cowan Publishing Company (the publishers of *CQ*) acquired the rights to *VHF Amateur* in the first days of August. At this writing the future of this institution in amateur VHF/UHF radio is unknown, although it is understood that *VHF Amateur* will become a section or department in *CQ*.

While this will certainly contribute considerably to the *professionalism* of *VHF Amateur* (as a department in *CQ*), we never felt that lack of professionalism hampered the future of "the early day VHF man's publication."

Bob Brown had many of the advantages that we have attempted to build into *VHF Horizons*. Bob was aware that VHF/UHF news is by its very nature a timely item. He recognized that the 45-57 day lead time (*i.e.* the period of time between the day that a magazine stops accepting editorial copy and the date the magazine actually came out) inherent with other amateur magazines was not materially contributing to the "operating state-of-the-art" in VHF and UHF.

So he set out to tackle this in the same way we did, later, here at *VHF*. Simply arrange your production and delivery schedules so that your printer can accept copy up to a matter of days (two weeks at the most) before the magazine hits the mails.

Now, with *VHF Amateur* absorbed by *CQ*, it loses what many felt was its primary appeal . . *i.e.* news while it was still news. For this we are deeply sorry and not a little concerned on behalf of the entire VHF/UHF fraternity, which we feel by now we have gained the right to speak for.

Somewhere out there are 2,500 or so subscribers to *VHF Amateur*. They probably feel a little left out right about now. Some probably also subscribe to *CQ*. While we feel certain that Cowan Publishing Company will work out the problems involved with changing over or extending their present subscriptions (to *CQ*), we wonder if this is enough?

If you are one of these 2,500 *VHF Amateur* readers, and you *do* feel a little left out in the cold (of old news), we would like to offer to you a six months subscription to *VHF Horizons*, at a token charge of $1.00. Please recognize that we do not have access to the subcription records of *VHF Amateur*. Therefore we must trust in the integrity of the amateur radio operator to represent to *VHF Horizons* his existing subscription in a truthful way.

Our reason for doing such a thing is simple enough. We feel that you subscribed to *VHF Amateur* for the same reason we did. To obtain news of VHF/UHF, exclusively. We don't want you to ever develop the feeling that you can no longer have this kind of service delivered to your doorstep monthly.

By offering you a six month carry-over subscription with *VHF Horizons*, for the token fee of $1.00, *we will see that you* keep in contact with the world of the very highs and ultra highs, during a period of time when 50 megacycles and up needs everyone of its newly found supporters.

OK . . . so the line starts at the right. Just drop a short note to *VHF Horizons* at P. O. Box 1557, Oklahoma City 1, Oklahoma with the information that you were a subscriber to *VHF Amateur* when the sale took place. Enclose your dollar, and we are in business!

VOLUME 1 — NUMBER 4
OCTOBER 1962

VHF HORIZONS

CONTENTS

Features

Departments

Publisher
Bob Cooper, K6EDX/W5KHT

Managing Editor:
Jim Kyle, K5JKX

Associate Editor
Russ Miller, W5HCX

Technical Editors:
Northern—Len Garrett, W7JIP
Ernie Manley, W7LHL
Southern—Paul Wilson, W4HHK
Western—Bob Grimm, K6RNQ

Research Consultants:
Jackson L. Cox, W0KMV
Ansel Gridley, W4GJO
Bob Richardson, W4UCH
Karl Blakeley, W5EBH
Ernie Brown, W5FYZ
Joe Harwell, W5JWL
Phil Patterson, W5SFW
John White, W5UKQ
Gib de la Laing, W6BJI
Alan Margot, W6FZA
John Chambers, W6NLZ
Norm Hawkins, VE6HO

Assistant Editor:
J. J. Jones

Advertising Director:
Stan Searle

Business Manager:
P. T. Pogue

Circulation Manager:
Deborah Carter

Circulation Assistant:
1—IBM 402 Computer

Chief Photographer:
Clifford King

Schematic Design:
Jean Schafer

Advertising, Sales Office
4 NW 7th Street
Oklahoma City 2, Okla.
Telephone 405—CE 2-1108

Call Collect for Advertising Data

Circulation Office
P.O. Box 1557
Oklahoma City 1, Okla.

OUR COVER

What can you say about a plain type layout? Design by K5QGO, to set off this special antenna issue—that's all. Inside, you find a separate antenna article for every VHF band in anything like wide use (except 432, and it's covered thoroughly in two of the other articles). Send us some pictures of your **own** antenna installation—you might find one on the cover of next year's Antenna Special.

SCATTER

. . . de K5JKX

CONVENTIONEERING . . .

One thing about summertime and being a ham magazine editor — you'll get your fill of both conventions and hamfests!

I just got back from the West Gulf division convention at Corpus Christi and already I'm trying to get the work ahead enough to make it to Syracuse for the big VHF bash. And if you think (like several people I know) that this is simple, then you should try filling 40 pages every month with interesting and informative articles.

Don't get me wrong. I'm not complaining in the least. These things are fun — but at the same time they make life a bit more complicated than it is already.

Like for instance the trip to Corpus. That one was the weekend of August 3-5. Our deadline to the printer for the September issue was August 6. It doesn't take higher math to figure out that the magazine either had to be put together early, or late — but not on time in either case.

But even with that deadline hanging overhead, Corpus was fun. Had a long visit with Bill Ashby, K2TKN. One of the most immediate results appears further on in this issue — his article on 1296 Mc antennas. Other things are in the mill, if Bill or I either one can ever scrape up enough time to do them.

And at this point, an aside to those of us who work only 50 Mc and scornfully refer to the 75-thru-10 regions as "DC bands": it comes as a bit of a shock to talk with people who work almost exclusively *above* 432 Mc. To them, 6 and 2 are DC bands!

Bill wasn't the only interesting VHFer at Corpus. I talked quite a bit with George Munsch, of San Antonio, about wide-band FM work on 6 and 2.

One thing many people don't realize about FM. When proper receivers are used, FM has approximately the same advantage over SSB that SSB has over AM! The only thing wrong with FM is that too many people try to receive it by "slope detection", and the results are definitely not as good as AM.

Anyhow, George and a bunch of other people scattered across the country are working with converted commercial two-way gear, mostly on 52.525 Mc although other channels are also in use. If anyone is interested, we can twist some arms for some articles on how and why you can get into this bunch.

And there were dozens of other people who stopped by the booth to pass the time of day. All in all, much fun.

We did find that large numbers of hams still hadn't heard of us, and others confused us with other publications.

So here's one place every reader can help VHF. Get on the air and tell people about us. Tell them to drop us a note for a free sample copy if you like — or just send us the calls and we'll do the rest. This way, maybe more people at the next convention will know who we are.

OUR DEPARTMENTS . . .

The eagle-eyed reader will notice a drastic absence of our usual departments in this issue. Specifically, among the missing are the VHF Showcase, D. C. Pulses, and Scanning the Literature.

However, a glance at the "Features" listing on the opposite page will rapidly explain why. With so much solid data on antennas for all our bands, something *had* to give — and the departments went for this issue only.

They'll all be back next month. If you've been following "Scanning the Literature" to keep up with all the other publications, don't worry about missing out on a month. Our new schedule put us at deadline before two of the three other major ham magazines came out anyway — so next month we'll be scanning the September issues.

Incidentally, I'd like to know what you think of our departments — *all* of them. Do you like them, or would you prefer that we use more of the space for technical material? After all, this is *your* magazine — and if you'll just tell me what you want, I'll do my best to give it to you.

What do you think?

—K5JKX

50 Mc

Designed and built by Edwin A. Pick, W0BBM
RR 3, Box 377
Imperial, Missouri

This photo story is aimed not so much at the 50 Mc enthusiast who is looking for a complete *nut and bolt* how-to-do-it story, as it is aimed at the 6-meter man who is looking for new ideas, or new uses for old ones.

The antennas (notice we are plural now) shown in these photos have been erected and put into the air over the W0BBM QTH during the past several years. The object of each of the arrays was extended ground wave, long haul weak signal skip, and scatter.

Over the period that each antenna was in use, careful observations were made to the effectiveness of each design. *Some* of these observations are included in this report. More will be made available at a later date as the totals are tallied.

Having read that long-haul scatter signals become pretty beat up, in respect to polarization of the original signal, during the scattering mechanism, we decided to experiment with various forms of stacking, and polarization switching.

Anyone who has worked a summer of E skip has probably had the opportunity to observe that under some very special conditions stations "on the other end of the line" (ie. 700-1500 miles distant) running low power into ground plane antennas, often times will compare very favorably with their higher power bretheren with much larger yagi arrays.

When working into an area that has both vertical and horizontal polarized stations in quantity (*ie.* Los Angeles basin and vicinity) it is often surprising to hear the top signal on the band announcing "I'm running a four element yagi and a G-50. *The beam is vertical.*" You are receiving on a horizontal antenna.

Too often we tend to chalk this up to a number of rationalizations such as (A) No one with comparable power and a horizontal antenna is active at the particular moment; (B) skip is so good that anyone with a 6J6 and clip lead would be S9; (C) skip is so spotty that this vertical fellow just happens to be in the right spot.

On the other hand, vertically polarized stations often find they are receiving better signals on skip from horizontally polarized skip stations than their horizontal brothers.

All of which leads those of us with a flair for imagination "could it be possible that the E skip mechanism actually twists the signal?'

Believe it or not, this is not a new thought. However, to the best of my knowledge, it has never been officially explored on a concentrated effort over a summer of E skip. It is hoped that this article, and others to follow over the winter ahead, will send enough 50 megacycle men to the aluminum piles to erect a number of switchable dual polarization beams for the 1963 E skip season.

But it was not E skip that first attracted me to the dual polarization antenna. It was, as noted earlier, scatter.

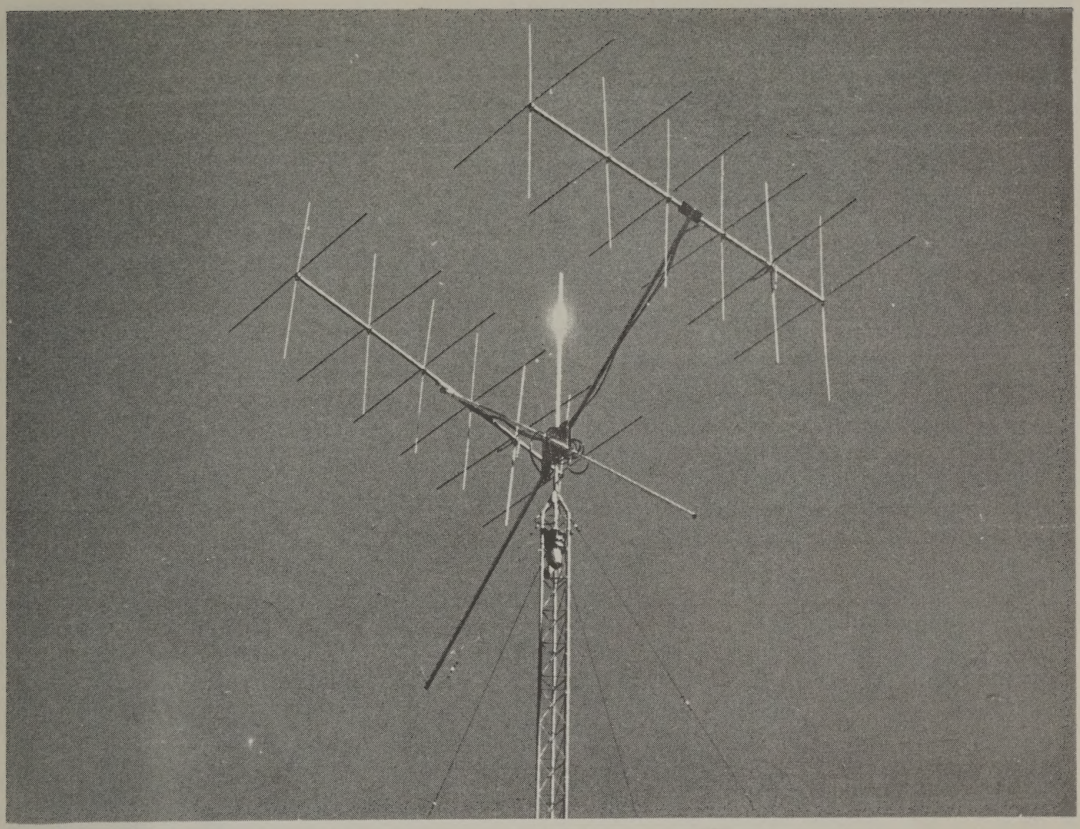
The scatter mechanism is one which displaces small globs of semi-ionized molecular concentrations in either the D or E layers of the ionosphere, or in the atmosphere itself, in the case of tropo scattering. There has been some evidence advanced that the semi-ionized globs are twisting (*ie.* rotating in a spiral) at an irregular rate as they fly through the layers involved. It is these globs, which, when excited by meteorites and ionospheric winds, cause momentary refraction (or reflection) of your 50 megacycle signal. In its most basic approach, ionospheric scatter is exceedingly short-lived E skip, occuring at a height just slightly lower in the E layer than normal E skip occurs.

Some have suggested that the twisting and spiraling of the semi-ionized globs which cause scatter to occur also twist the plane of the signal as the signal reflects from (or reflects in) the glob it passes into and through.

It is on this basis that we attempted the design of an array which would give us the following options at the throw of a switch:

(A) Horizontal only
(B) Vertical only
(C) Clockwise circular
(D) Counter clockwise circular

As far as this array went, it did just that. However no attempt was made to sample via any automatic means the relative signal levels on each of the four choices of polari-



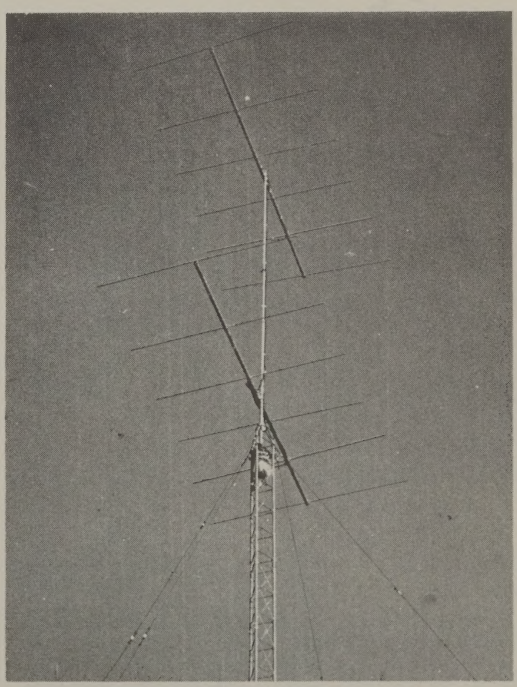
Diversity 12 by 12 array at WOBBM, Imperial, Missouri. Boom lengths—15 feet, spreaders 20 feet long. Antenna height 70 feet above ground. A late winter storm brought this one down with 4 inches of ice loaded on the cross members.

zation, thereby choosing the particular polarization which was producing the greatest signal level at any given instant.

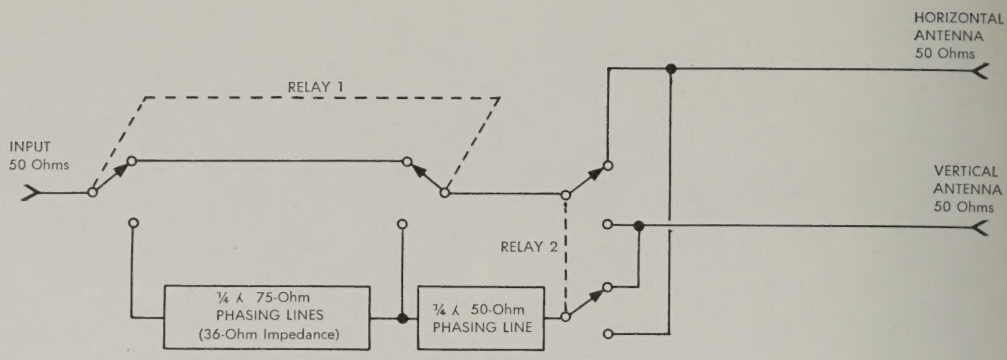
Diagram one shows the very simple means employed to select any one of the four polarization modes. The principal means of phase change was the use of ¼ wavelength coaxial delay lines, which by simple addition and subtraction to the basic phase of the input signal (left hand side of diagram 1) resulted in any of the four choices of polarization desired.

Notice in diagram 1 that we are maintaining a 50 ohm output in either vertical, or horizontal, or circular polarized arrays. Keep in mind, when duplicating any part of the switchable feed system, that the ¼ wavelength phasing transformers must have the velocity factor of the coax you choose to use calculated into the actual phasing line length. Note also that both 75 ohm and 50 ohm coaxial cables are employed in the phasing array.

Diagram two offers two possibilities for phasing together together either 2 or 4 fifty



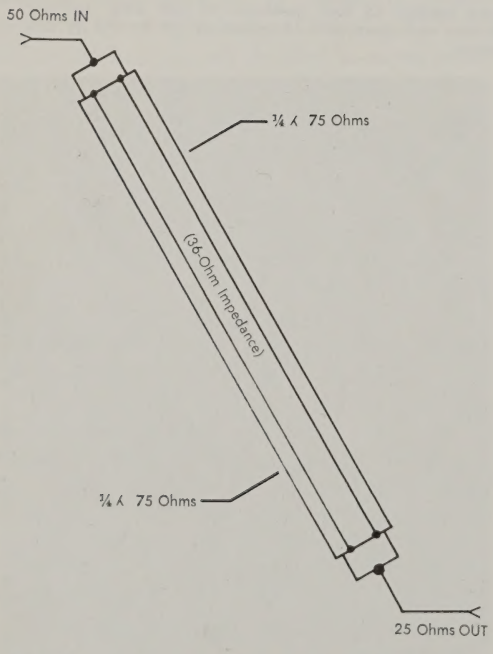
Horizontal 6 over 6 shown here produced a 48-state WAS in 5 months in the 1961 E skip summer season. Boom's 15 feet long, vertical spacing 18 feet. Top antenna 80 feet above ground.



POLARIZATION CHOICES

RELAY 1	RELAY 2	
	NORMAL	ENERGIZED
NORMAL	HORIZONTAL (Only)	CLOCKWISE CIRCULAR
ENERGIZED	VERTICAL (Only)	COUNTERCLOCKWISE CIRCULAR

Diagram 1



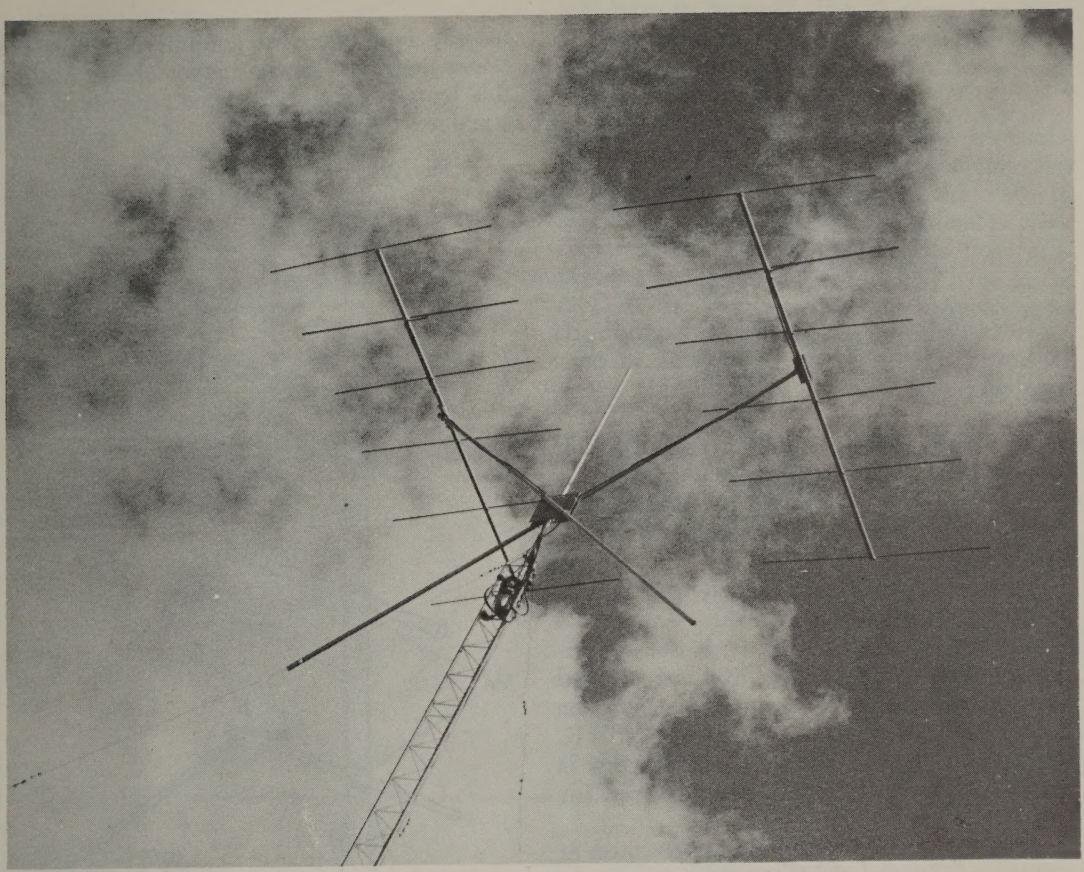
1. Stubs can be made up with connectors, or soldered and taped, with coax connectors only at input and output.
2. Parallel 75-ohm ¼-wave lines are used to match two 50-ohm antennas to one 50-ohm line.
3. Parallel 50-ohm ¼-wave lines may be used to match 4 50-ohm antennas to one 50-ohm line.

Diagram 2

(50) ohm yagi antennas into a single array These methods are, of course, good whether you are stacking horizontal and vertical yagis on the same boom, as was done in photo 1 with the 24 element (12 vertical and 12 horizontal) dual diversity array or if you are simply stacking 2 or 4 yagis in the vertical plane (photo 2) or horizontal plane (photo 3.).

SELECTIVE SAMPLING

With an antenna such as is shown in photo one (24 elements) you have the makings for a polarization diversity array which offers selectable polarization, depending on the signal level present in any one of the four polarizations (*ie.* horizontal, vertical, clockwise circular, counter-clockwise circular) at any given instant. With a single feedline to the receiver (converter) this limits you to manual selective-sampling. In other words, you rotate your relay changeover switch in the shack listening for audible changes in the signal level you are working with, picking the polarization position which produces the best signal to noise ratio.



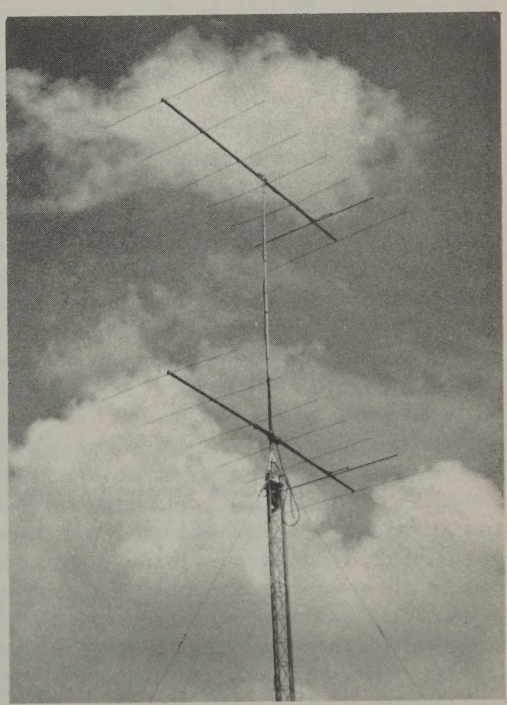
Horizontally stacked 6 by 6. Boom lengths 15 feet, spreader lengths 20 feet, antenna height 70 feet. This array suffered on low angle long haul paths (tropo scatter).

PERFORMANCE

The array shown in photo 1, with two booms, each of which had a six element vertical and six element horizontal antenna mounted thereon, was a real winner on short-haul scatter (high angle work) and E skip. However it was not as good as the stacked 6-6 or 7-7 for low angle work. It is felt that this antenna (the 24 element dual array) would have performed well on low angle scatter also, had we been able to add an additional 24 element array on the bottom of the spreaders, identical to the top mounted array. However the ice of a late winter storm beat us to it this spring and the entire array, coated with ice as big around as your wrist, came shattering to the ground!

It is hoped that many serious minded 50 megacycle amateurs will give consideration to this basic design in the winter months ahead with an eye toward real evaluation of the four modes of polarization over paths likely to produce shifting polarizations due to irregularities in the troposphere or ionosphere.

W0BBM



Vertically stacked 7 over 7 presently in use at W0BBM, pending completion of a more elaborate dual diversity array. Boom lengths 20 feet, vertical spacing 18 feet. Top antenna 80 feet above ground.

144Mc

by Russ Miller, W5HCX
Associate Editor
VHF Horizons

The construction techniques of building a colinear usually presents problems to most amateurs who attempt to build this antenna type.

Seemingly, the antenna appears difficult to construct when it really isn't. In fact, its odd size plus the mechanical problems has in reality scared off a lot of erstwhile builders. Don't let it scare you.

A colinear array, particularly at 2 meters and up, will give you a healthy amount of gain, has a good capture area, is not specifically a narrow band device and can be used over a wider range of frequencies than the Yagi without introducing a serious VSWR. Also, the radiation pattern of the array is naturally broad and eliminates the need for precise aiming.

Building a colinear can be approached in a number of ways. Of first interest is mechanical strength to keep storms from damaging the array. Weight is also a consideration since too heavy an array makes its mounting difficult. A colinear need not be heavy. Size is important because the physical area of the array determines its performance.

The best all-around size at 2 meters is the 16-element array. The array described here is a simplification of the usual construction process. The antenna is constructed from aluminum tubing and steel conduit, the latter used for the boom and the cross-arms. Lashing it together consists of arc welding the cross-arms at their mid-point to the boom as shown in Figure 1. The letter "W" indicates the weld point in the illustration. The next item is the insulator support plates which, by the way, are designated as 'mending plates, 1" x 6" with 10/32 countersunk holes' and are available from local hardware stores or suppliers. These are also made of steel and can be arc welded to the ends of the cross-arms. Why weld the steel parts together? Rigidity is one reason, and the other is cost. It is cheaper than using numerous U-bolts and clamps.

Figure 2 gives all the necessary dimensions. One thing you may notice is the unusually long piece of conduit used for the boom material. If you cannot obtain a piece this long, have a short piece arc-welded to a standard 10' length.

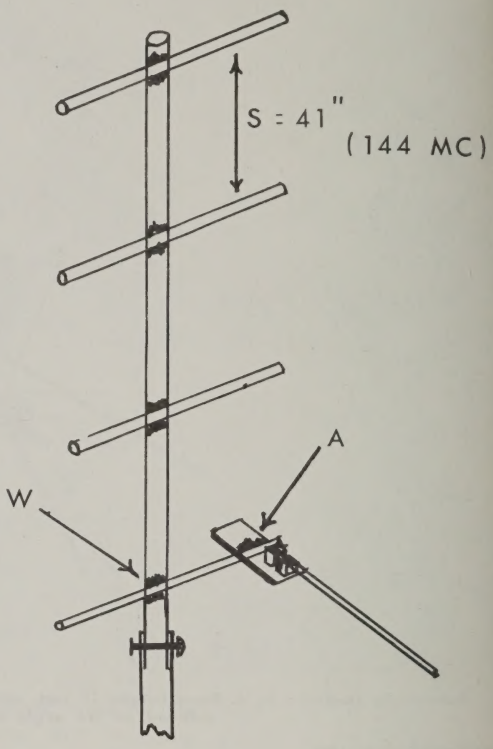


Figure 1

The insulators used with this array should be ceramic, although glazed steatite will do. The insulators should be approximately 1" square by 1¼" high with 10/32 threaded holes in each end. The elements are held fast to the insulators with standard ½" fuse clips. See Figure 3 for details. The fuse clips are available from a number of sources through the surplus stores have the best selection. Holding the elements in the fuse clips can best be done by drilling a hole through the fuse clips and the elements and securing the assembly with 6/32 bolts and nuts. This will also give you a place to fasten a phasing harness.

Feeding the colinear is like most all other arrays; it *must* be matched to the feed line. The actual impedance of this array at the feed point does not approach any figure that can be easily matched. If a ½ wave balun is usd with 72 ohm transmission line, an approximate match will be obtained. However, if you want to lower the standing wave ratio to better that 2/1, a ¼ wave matching stub

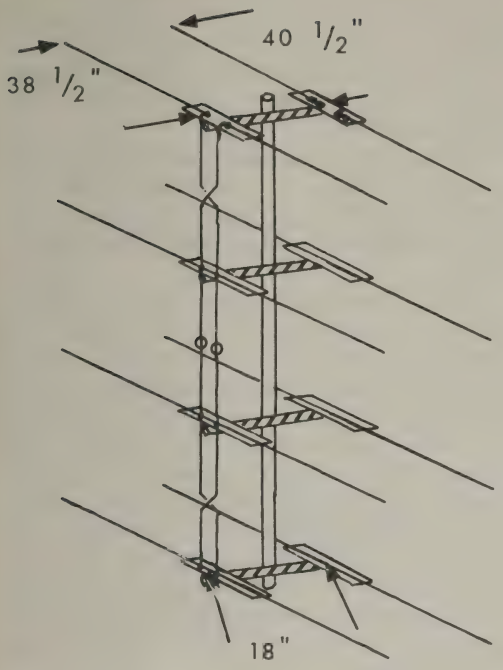


Figure 2

will have to be used. The ¼ wave matching stub is adjusted by moving the transmission line point of connection up or down until minimum SWR is reached.

Slight adjustment of both the transmission line connection and the shorting bar then should be made to reduce the SWR to as close to 1/1 as possible. Incidently, since the array is a balanced device and the transmission line is not, a balun will have to be used at the transmission line connection to the ¼ wave matching stub.

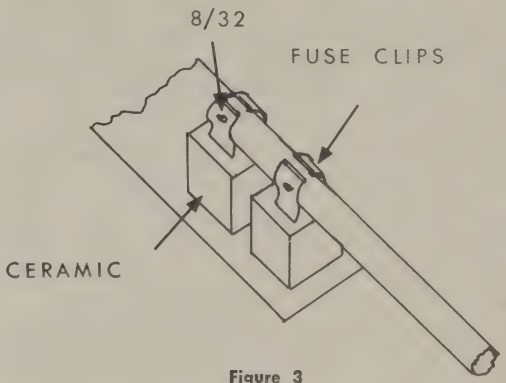


Figure 3

Letters

Dear VHF:
Received the complimentary copy of VHF yesterday and after having ingested its contents wish to apply for future as per enclosed subscription form. To me it appears that you are off to a good start with a long needed tool for the serious VHFer and with the staff you have listed on page two, this effort should be very successful.

Judging from the W4IKK/W4HHK article, you may have lost contact with Bill. He is now associated with AEDC at Tullahoma, Tenn. At last accounting, he was running six watter on 50 Mc rather sporadically due to work and study.

C. A. Waterhouse, W4INM
700 Marlboro Avenue
Chattanooga 11, Tenn.

OM—
Thanks for the note on Bill's location; the first time ye ed worked him, he was running 5 watts on a mountaintop during a tropo opening—so we'll be looking for his mighty 6-watt signal again!

Dear VHF:
First I would like to say your new magazine looks real good. I already know of 10 subscribers locally. The next thing I would like to know is what are you doing to your modulation on W5KHT SSB rig. During the VHF contest it sure sounded good. If there is anything I can do to help the magazine let me know.

73
Ken Halladay, K6HCP
San Jose, Calif.

Ken—
The W5KHT modulation secret is nothing more than Art Collins KWM-2. They don't come any better! You, and others, can help by simply spreading the word about VHF. We'll gladly mail a sample copy to anyone requesting same . . . provided they haven't received a free one previously. Pass that word around!

Dear VHF:
Thank you for the complimentary copy of your new VHF Horizons magazine. Frankly, I compared it (August issue) with the 3 ham journals I now subscribe to and came to the following conclusion of preference; in this order: 1—QST, 2—73, 3—CQ, 4—VHF Horizons. I also had access to two other ham journals, VHF Amateur and Western Radio Amateur, both of which I would cast below your magazine.

Try me again in the future; possibly by then you may have achieved the key to a superior journal at which time I'll buy.

73's
Vin Salemme, K6VUB
Livermore, Calif.

Dear VHF:
After devouring the meaty information in every page, I just had to collar myself and forward the enclosed subscription. I am interested in NFM at present and would like to round up other enthusiasts thru your columns. Most of my NFM operation is on 6 meters.

73
August Oechsli, K2PQY
Massapequa, L. I., N. Y.

August—
Stand by for a deluge of letters from NFM enthusiasts. How about it, gang?

Dear VHF:
Congratulations on the fine publication which covers most interesting topics. Finally the Technicians have been recognized as a powerful group who have no beef with anyone. The need for such a magazine has been filled.

Best wishes
Daniel R. West, K6DRX
Menlo Park, Calif.

Dan—
Thanks for the comments but we must set one thing straight: VHF is published for the technician, not for the Technician. We all feel that high technical interest is the lifeblood of VHF ham radio — but when it comes to the class-consciousness which a few hams of all license classes try to foster, we draw the line. To us, a ham is a ham is a ham — and if he's interested in VHF work, we're all for him no matter what the "'class" of his license!

220 Mc

by Robert Grimm, K6RNQ
Western Technical Editor
VHF Horizons

After loading the 220-Mc rig up to a kilowatt one cool summer evening and burning up the transmission line to the 13-element long yagi in the process, the author made the marvelous deduction that he might have an SWR problem. This is later confirmed by a check which showed SWR of 10 to 1.

Now very few hams have the patience and/or equipment to properly tune a very long yagi for optimum forward gain, this being no simple task. At this point it was decided that a simpler antenna of equivalent characteristics would be highly desirable.

A quick check with George (let George do it? No.) W6OKR, in Larkspur, gleaned us some data on a very interesting little 6-element yagi.

One of these little gems was put together quite easily using ¼-inch aluminum tubing, which was readily available at the local surplus outlet. A quick trip to the neighborhood hardware store netted us some nice ¾-inch aluminum tubing for the boom. After some fast calculations and a little work with the drill and hacksaw, there was a 6-element yagi.

It was tried out and the results were so gratifying that I decided to put up a small array using four of these little gems in a quad stack. This quad-stacked array turned out so nicely that this article was the results!

Gain figures are not too easy to determine accurately at this frequency; I'll just say it outperforms the old long beast—and has no problem either!

The stack spacing is 0.85 wavelength vertically and 1 wavelength horizontally. All elements were cut from 1/4-inch aluminum tubing and the booms (as mentioned before) are 3/4-inch aluminum. The elements were force-fitted through 1/4-inch holes in the boom and then the edges of the boom were punched down with a center-punch to lock the elements securely in place without any hardware.

One of the first things you will probably notice is the rather peculiar staggered length of the directors; this results in slightly more gain than would be attainable with tapered directors and is not a typographical error.

The element lengths and spacing distances are shown in Figure 1. Design center frequency is 221 Mc.

The phasing lines were made from 1/2-wavelength sections of transmission line. We used Gonset Silver U line but almost any type of balanced transmission line could be used.

The folded-dipole section of the driven element is made from No. 18 enameled copper wire spaced 3/4 inch from the driven element. Ceramic standoff insulators were used to support the dipole at the feed points. About the easiest method of attaching the dipole to the driven element is to flatten the outer half-inch of the ends of the driven element and drill a hole 1/4 inch in, for a 6-32 bolt. The No. 18 wire can then be fastened either by wrapping it under the bolt or by use of soldering lugs. Be careful to scrape the insulation from the wire to get a good electrical contact.

The front-to-back ratio of the array is approximately 18 db while VSWR at center frequency measures 1.2 to 1. The pattern is needle-sharp in the forward direction, with deep nulls so you can drop out QRM (!). Feedline of 300-ohm or 450-ohm open type is suggested.

Balun Lengths

Many antenna-matching systems use the familiar half-wave balun. But to be a half-wave long, which is necessary for the balun to work right, the physical length must be reduced according to the "velocity factor" of the cable.

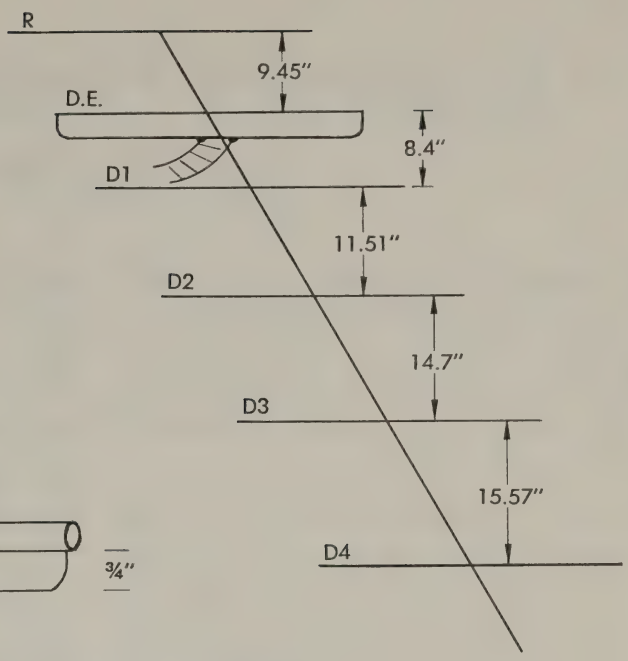
So long as everyone used ordinary coax (RG-58, RG-8, etc.), all "velocity factor" figures were the same and you could trust published balun data. However, the new low-loss foam-type coax has a *different* velocity factor — and this may be why your balun doesn't seem to work quite right.

The following table gives balun length, in inches, for the most popular bands for both old and new types of coax.

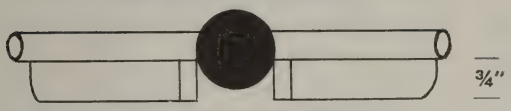
Freq. (in Mc)	Ordinary Coax	Foam-Type Coax
50.3	77½	91½
52.0	75	88
144	27	32
146	26⅝	31½
221	17⅝	20¾
432	9	10⅝

REFLECTOR	26.25"
DRIVEN ELEMENT	25.0"
Director #1	23.62"
Director #2	23.3"
Director #3	23.45"
Director #4	23.61"

½ SECTION OF 300 OR OPEN WIRE LINE = 23.9"



FOLDED DIPOLE DETAILS.



#18 ENAMELED WIRE FOR 300 OHM FEED

Figure 1. Element Length and Spacing Details

STACKING DISTANCES ARE CENTER TO CENTER

STACKING DETAILS (DIPOLES ONLY SHOWN)

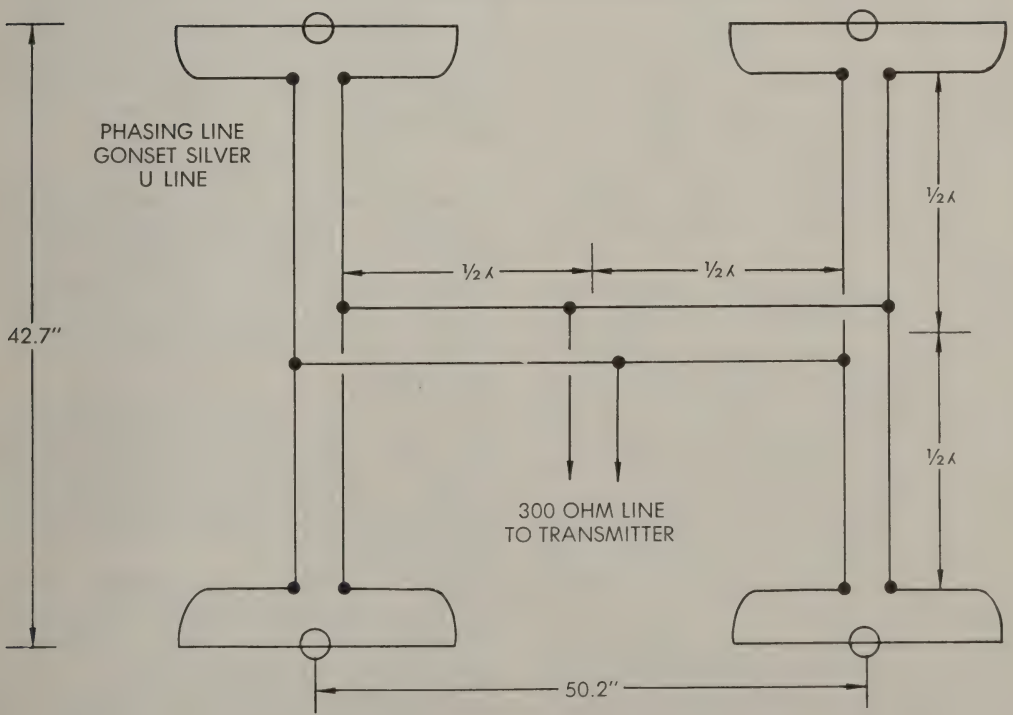


Figure 2. Phasing Harness Construction and Stacking

Antenna Construction

by Paul M. Wilson, W4HHK/A4HHK
Southern Technical Editor
VHF Horizons

During the past fourteen years of VHF operation, the writer has built and used a number of antennas on the 50, 144, 220, and 420 Mc bands. Some were mechanically sound and worked well electrically, while others ended up in the antenna graveyard on the back side of the lot.

Experience has shown that certain construction techniques are reliable. It is the purpose of this article to pass on some tips and recommendations that have been employed successfully at this station. They are not to be taken as the "only way to skin the cat", but tried and proven construction employed personally.

All-metal construction is a must. Wooden frames and supports are difficult to build to close tolerance and cannot be maintained in this condition because of the effects of time and weather. In addition, all-metal construction is safer from the standpoint of grounding for lightning protection.

Metal parts such as U-bolts, brackets, screws, bolts, etc., should be sprayed generously with a clear plastic spray such as Krylon or painted with metal primer paint. The latter is available in spray cans, also, for small jobs as well as in larger quantities, and comes in a choice of two colors, red or green.

Construction using tubular booms and framework offers minimum wind resistance, but it can result in other problems. Mounting several elements in line along a tubular boom requires great care in construction. The use of V-blocks for holding the boom while drilling the element mountings holes does *not* insure that all of the elements will be precisely in line when the job is finished. For the amateur who is not a machinist one solution to the problem is the employment of square boom stock.

A drill press is a must, in any event, if one is to drill holes "straight through" the boom and to the size producing a tight fit that requires the elements be forced through by tapping gently on one end with a wooden hammer. With the element centered in the boom, a pilot hole is drilled through the boom and one wall of the element tubing. A sheet metal screw is then run through the boom wall and element wall. The tip of the screw does not penetrate the opposite wall of the element tubing, but approaches it. The head of the screw should be sprayed or painted to prevent rusting.

There are other methods for mounting elements such as cast aluminum brackets (for tubular booms) and soldering techniques. The brackets are well suited for 50 Mc antenna construction. On 432 Mc where elements lengths and diameter are small, copper tubing or pipe booms and hard drawn copper wire elements can be assembled by drilling and soldering.

A rule of thumb in determining the boom size and element diameter (where square boom stock is used) is to make the dimension of the square tubing twice the element diameter. For example, ¼ inch diameter elements, suitable on 432 Mc, would mount with ½ by ½ inch square boom.

On 144 Mc a 32 element collinear-broadside array has been in use continuously for the past nine years at this station that employs 1 x 1 inch square booms and ½ inch diameter elements. To date all elements are still intact, and in line, despite severe windstorms encountered during the annual tornado season.

One half inch diameter elements have been used successfully in six meter arrays. They have held up well, but do have a slight amount of droop, and perhaps five-eights inch or three-quarters inch diameter elements would be desired.

Element diameter is not critical (electrically) in collinear-broadside arrays, but is extremely critical in yagi construction, especially on 144 Mc and higher.

The addresses of firms in your city handling aluminum stock may be found in the

DRP*

A FIRST-IN AMATEUR RADIO PUBLICATIONS

— *Direct Reader Participation —

There's good news galore from the **Pace Setters** this month. For in addition to the many excellent (and exclusive, we might add) Antenna Features in this month's issue, we have a storehouse of excellent articles planned for the November and December issues, just around the corner.

The December issue, for example, will carry a full report on the Syracuse 8th Annual VHF Round-Up. This will be out November 15th.

But the really big news this month comes from **your** shack . . . and from **you.** Its our brand new **"DRP Program"** which stands for "Direct Reader Participation." Here's how DRP works.

VHF-UHF NEWS FOR THE MONTH OF _____

from Amateur Radio Station _____, QTH _____

This month we built the following _____

_____ And, we improved

the following gear _____

On the air, we worked (DX) _____

_____

(include dates, times-sampling each opening). New stations (calls only)

heard on locally _____

We are searching for information on _____

Articles we enjoyed in October issue _____

By this point you have read through the post-card form above. Each magazine, each month, will contain just such a card. When you fill it in (all or part) and send it along to VHF, we think you will be improving your hobby, and helping, your fellow VHF-UHF'ers as well. For example, if you need information on neutralizing a 6CW4, the card will tell us so. If we can't supply the answer, a brief line in VHF will probably bring you the data from another reader. This is **DRP—Direct Reader Participation.**

How about getting into the swing of **DRP** the first month by returning the card to us right now?

Oh yes, if you are receiving VHF for the first time this month — fill in a subscription form on the reverse side . . . **and we will see you again next month!**

73

YEA MAN — SIGN ME UP FOR A SUBSCRIPTION **THIS** MONTH!

(tear out and airmail with check or money order)

Dear VHF Guys:

_____Attached is my $4 Put me down for **15 issues** of VHF because I am so speedy. **I am mailing this before September 30.**

_____Attached is my $4 Put me down for **14 issues** of VHF because I am also pretty speedy. **I am mailing this before October 6.**

_____Attached is my $4 Put me down for **13 issues** of VHF. I'm not so speedy but I sure have to have VHF every month. **I am mailing this after October 6.**

Name _____ Call _____

Address _____

City/Town _____ Zone _____ State _____

Place
Stamp
Here

Airmail to:

VHF Horizons News—DRP

Box 1557

Oklahoma City 1, Oklahoma

USE THIS FORM WHEN SUBSCRIBING AT SYRACUSE VHF ROUND-UP

OK VHF GUYS:

You have cornered me unmercifully at the Syracuse VHF Round-up. You twisted my arm twice around and stepped on the 4X150 that I won at the raffle. All in all you have been much too understanding. So here is my **$4** for 15 issues of VHF Horizons.

Name _____ Call _____

Address _____

Town/City _____ Zone _____ State _____

Note:

This form can be mailed in case you missed us in Syracuse. **Only 13 issues however.**

yellow pages of the telephone directory, or write to: Dick's, 61 Cherry Ave., Tiffin, Ohio, for his list of tubing, angle, channel, and sheet aluminum for amateur construction.

One weak point in any array is the connection of the phasing line or feed line to the element. If possible, solder lugs should be avoided. They have a habit of flexing and eventually fatiguing . . . breaking loose.

One solution is to use No. 12 or No. 14 solid copper wire for the phasing lines. At the point of connection, the end of the wire is scraped clean and formed into an eye. A machine screw with flat washer under the head is run through the formed eye and then the hole in the elment wall. On the inside of the element an internal washer and nut complete the connection. The final step is to spray with clear Krylon or paint with metal primer.

On 432 Mc where the element diameter may be one-quarter inch, the end of the element may be flattened for a distance of about one-quarter inch, and the hole drilled through both walls. The flattening should start gradually to avoid cracking the aluminum. A vise is used for this job.

If solder lugs *must* be used, secure extra heavy ones, or double up on two normal-thickness lugs. The element ends should be corked or sealed to cut down on wind noise (neighbors dislike antennas that whistle) and keep out rain. During winter weather water trapped inside an element may freeze and burst the tubing.

Another problem is the support of phasing lines. They must be supported frequently or they will sway and flop when the weather is windy. Excessive movement will lead to the breaking of solder lug connections and/or polystyrene insulators.

On 50 Mcs and 144 Mcs phasing lines made of No. 12 solid copper spaced one inch, center to center, have held up well where properly supported. Kilowatt type 300 ohm tubular line may be used for phasing sections, but it, too, must be supported adequately or conductor fatigue will occur at the connection point. In addition, the "up-hill" end should be sealed (with poly rod and dope or poly material) to keep out water and the "down-hill" end left open to allow the tubing to "breath". Otherwise, moisture will build up inside.

The same practice must be followed where this type of line is used for the feedline. should be formed on the outside with a small Where the line enters the house a "drip loop" opening cut in the underside to permit collected moisture to drain out. Care should be used to avoid cutting the conductors when doing this.

Some amateurs have had mysterious results where tubular line was used and moisture could build up. The strength of local signals would vary considerably from time to time. Some of the inexpensive TV type hardware is well suited for phasing line support . . . but not all. The type affording minimum capacity to ground is desired. Care must be taken to preserve line balance to the metal frame and mast. These stand-offs tend to rust easily, so should be sprayed with clear Krylon or painted.

A phasing line trick worth remembering is that the line repeats the load impedance every half wave. Because of this, the exact impedance of the line is not critical if line length is a multiple of a half wave.

This characteristic may be used to good advantage at times. The writer's six meter beam has a 200 ohm feed point. A half wave section of phasing line (no. 12 spaced one inch) carries this 200 ohm load down the mast to a conveniently mounted balun. The balun, made of RG-8U coax, transforms the balanced 200 ohm load to an unbalanced 50 ohm value. RG-8U is run from this point to the shack. A bracket supports a small plate for mounting the SO-239 connectors to which the phasing line, feedline and balun section connect. The connectors of the coax line and balun section are taped with poly tape and sprayed with Krylon after being screwed up tightly. The use of connectors to head up the ends of the coax makes it easy to connect or disconnect and facilitates weather-proofing.

The length of the half wave section of coax for the balun may be safely determined by formula for 50 Mcs work (66% of 114 inches); for 144 Mcs and higher, it is recommended the length be checked with a calibrated grid-dip meter with the coax fittings (plugs) on the cable. The line should be an electrical half wave for the middle of the band in question or the frequency of operation, depending on the amount of frequency changing employed.

(Turn to page 37)

1296 Mc

by Bill Ashby, K2TKN
Box 97
Pluckemin, New Jersey

Everyone who has managed to get a watt or two of power above 1000 Mc forgets all about making contacts for a long time. The possibilities for antenna design are countless and very intriguing. The fact that high-power, narrow beam-width antennas can be built with a few scraps of wire and a soldering iron, with plenty of space in the average room to make all kinds of experiments, is too interesting to pass by. Simple test equipment is not hard to build, accurate enough to show relative gains of various combinations, but exact values in actual db are very difficult to come by.

Ten years of work by numerous amateurs have produced the following deductions about antennas for 1296 Mc and up:

1) Yagi types will work, but are very difficult to put on frequency. Attempts to scale down dimensions from lower frequencies do not normally produce good results.

2) Driven arrays of dipoles, so-called co-linears, etc., are easily built, matched, and capable of medium gains (approximately 18 db) before multiple-matching problems catch up. Frank Jones, W6AJF, in his VHF handbook, has excellent designs to start with.

3) Rhombics, V-beams, and other long-wire arrays can be made to work, but directivity and gain leave much to be desired.

4) Helical antennas are excellent, easy to build and match. An informative article recently appeared in QST. The predicted reduction in gain when working with a linear antenna does not show up in practice.

5) Above 1000 Mc, passive reflector antenna arrays really start to work. A 90-degree square corner, 12 inches on a side, with a "bow-tie" driven element, cannot fail to give 10 db gain. Careful adjustment of the driven element, feed and matching, plus postion in relation to the reflector, will produce 13 to 14 db gain. Stacking four of these wide by four high is practical and will produce gains in excess of 28 db.

Like all multiple-feed arrays, the major problem is getting exactly the same amount of power, in exactly the same phase, to each driven element. For gains in excess of 30 db, the only practical method known is to use a horn or circular parabola.

High-gain horns are not efficent from the size or weight aspect, but small horns make excellent feeds for parabolas. The feed problem eliminates the possibility of using a cylindrical parabola, but parabolas of revolution are easier to build anyway. Excellent reflectors have been made by amateurs using plywood, aluminum, or steel, up to 26 feet in diameter.

The curve necessary for the ribs of the framework is easy to derive, without any complex mathematics — all that is needed is a steel wire or measuring tape and a square. Decide what will be your focal length. This is the distance your feed will be in front of the dish. 50 percent of the desired diameter works out very well in practice (this is known as a 0.5 F/D parabola).

Lay out this line full scale on a fairly flat surface, such as your basement (or garage) floor. Mark the focal point "A" and the other end "B". Lay out another line absolutely perpindicular to A-B and inter-

EDITOR'S NOTE: We went all-out to be sure you had good information on 1296-and-up antennas in this issue. We contacted everyone we knew of working in this region and solicited contributions. By press-time, it was obvious that we were getting snowed under. Because it offers a number of new and intriguing ideas, we're featuring this month Bill Ashby's collection of tips. Next month, we'll hear from the West Coast as W6MMU, Don Goshay, presents his ideas ,including another, different dish feed system) and K6GKX, Ralph Steinberg, of the Microwave Society of Long Beach, tells how to build a colinear dipole array for 1296 in a matter of minutes. If you get infected by the bug and decide to forsake such "DC bands" as 6 and 2 in favor of the exciting region above 1000 Mc, let us know. And we'd like to see some snapshots of any dishes built as a result of these articles — who knows, that might make for a couple of interesting pages some time next spring!

—K5JKX

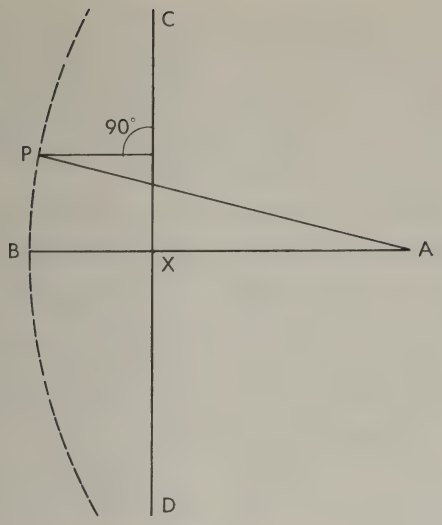


Figure 1

secting it at about 1/3 of the way from B to A. Mark the intersect point "X" and the ends of the second line "C" and "D". C-D should be a little longer than the desired diameter of the dish.

Drive a nail at point A, and attach one end of the steel tape. Then stretch the tape to point B and back to point X. Mark the tape well here, for this distance (A to B to X) now is our standard length. Using the square to always keep the tape perpindicular to line C-D, move the marked point of the tape from X out toward C or D. The point where the tape folds ("P" in Figure 1) to go back to point A is always a point on the actual curve of the parabola.

The focal length is fixed, but any diameter can be had by drawing a line parallel to C-D that intersects the parabolic curve at the desired diameter.

As you can see, any energy leaving the focal point A that reflects from the parabola will be in exactly the same phase as any other. You have ray-traced your design full scale, and it always works. A plywood template is drawn, and the rest is easy.

I have used yagis, square corners, dipoles with reflectors, slot, and horn feeds for various dishes; all with success of some sort. However, a horn antenna, designed so that the 3-db points of its pattern fall just outside the edges of the dish, always gives maximum gain. My 0.5 F/D 20-foot diameter dish with a good horn feed (9 inch square opening) allows the feed to be as much as 12 inches off the true feed point before any gain decrease is noticed.

(Turn to page 23)

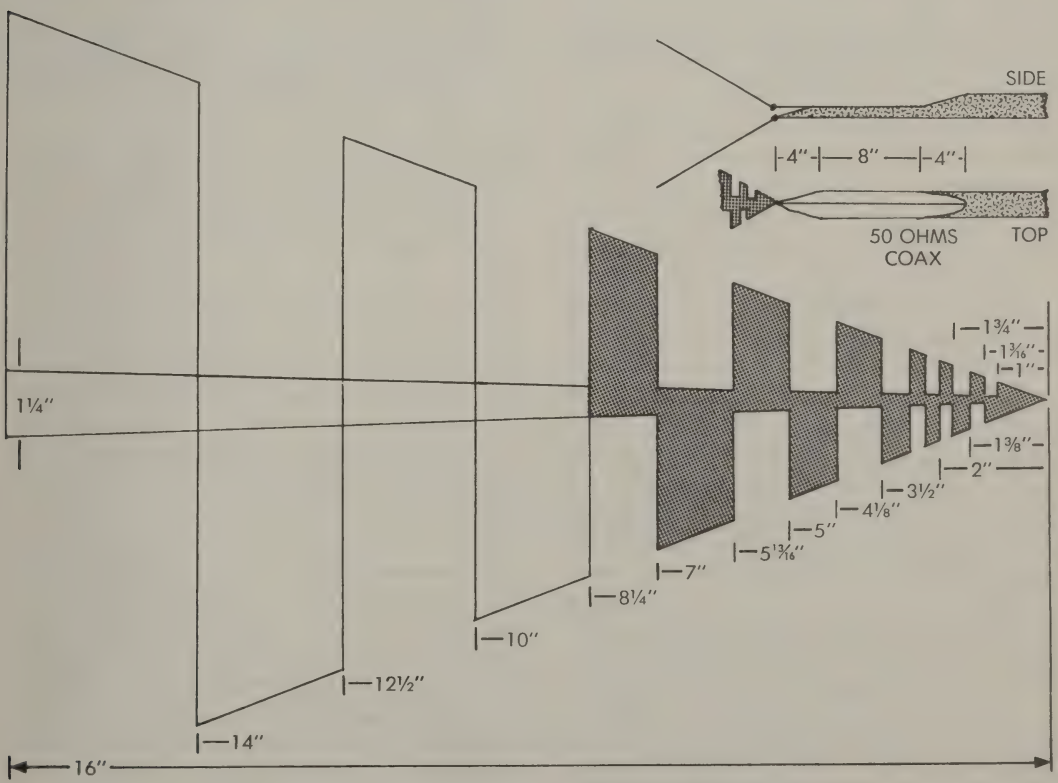


Figure 2. Log-Periodic Feed for 400-2500 Mc

3300 Mc (and up)

by George F. Tillitson, K6MBL
462 East Grove Street
Pomona, Calif.
(holder of one end, 3300-Mc record)

This article, although directed toward the 3300 megacycle band, is applicable to the 2400, 5700 and 10,000 megacycle bands as well. It is written not as a construction article, but as a guide to present and future microwave enthusiasts in their antenna selection and design.

At 3300 megacycles, the 9 centimeter wavelength is small enough to make almost any type of antenna possible. The problem is to select the most practical type for amateur use on 3300 Mc.

Since most 3300 Mc amateur operation is performed with microwave power output in the 100 milliwatt region, a high gain antenna system is necessary. Low power operation allows pola-plexing or simultanous transmission and reception using transmitting and receiving antenna polarizations at right-angles to each other. The pola-plexer provides a waveguide feed system for the antenna. (More on this later).

The parabolic reflector and the conical horn appear to be the most practical antenna types for use on the 3300 Mc band. Both types are broad band antennas, require a minimum of elements to adjust and will support a dual polarization type communicatons system.

The parabolic reflector, or "dish", will produce a directional beam, following the laws of optional reflection. It is a type of mirror having a focal point located along the center axis (Figure 1). When a source of microwave energy is situated at the focal point, illuminating the parabolic reflector, the energy will be reflected in such a way that it travels outward and parallel to the axis of the reflector. The reflector size determines the forward gain of the parabolic reflector.

In other words, the larger the diameter of reflector, the greater will be the forward gain and the smaller will be the beamwidth. For example: an 18 inch diameter parabola at 3300 Mc will provide 21 db gain over an isotropic radiator, with a beamwidth of approximately 14 degrees. An 8-foot diameter reflector at the same frequency will provide a 36 db gain and a 2.5 degree beamwidth.

Before you run down to the local surplus emporium and purchase that eight or ten foot radar antenna, consider the problems involved with the larger size reflectors. Besides having high gain capabilities, they also have

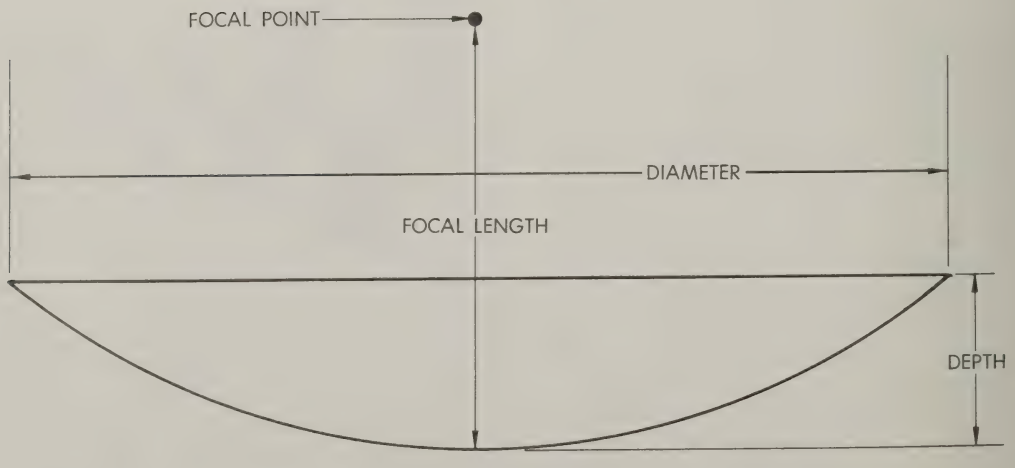


Figure 1. Parabolic Reflector

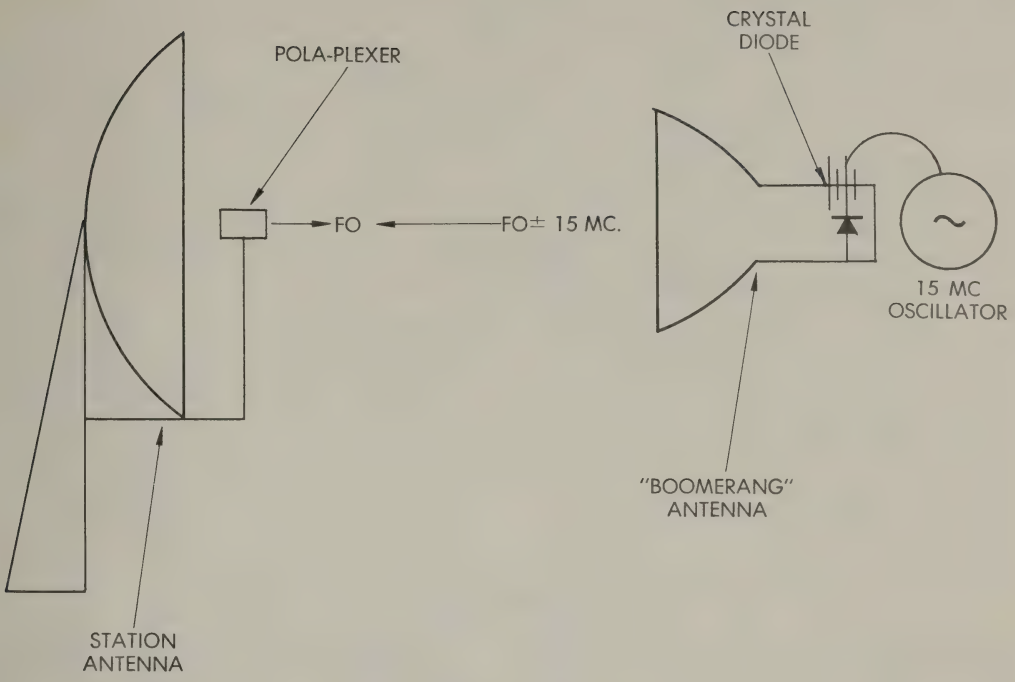


Figure 2. Boomerang Focus System

greater weight and wind resistance. A solid eight foot parabolic reflector can place over 1000 pounds of torque on your rotating system in a 70 mph wind. A four footer can produce 260 pounds of torque under the same conditions. A perforated reflector will decrease the wind resistance, but will limit the reflector's efficiency at higher frequencies.

I have found that a four-foot reflector is about the largest that one man can handle easily. I have mine mounted on a sturdy surplus light tripod capable of being operated as a "mountain-top" portable unit or placed on my garage top for fixed operation. The method of mounting the reflector will be left up to the ingenuity of the individual, as each reflector presents a different mounting problem.

The feed system for the parabolic reflector must be placed precisley at the focal point for maximum forward gain and minimum sidelobe structure. A simple equation that can be applied to the reflector to find the approximate focal point is: FOCAL LENGTH = DIAMETER SQUARED / 16 x DEPTH. The feed can be placed at this point and experimentally adjusted for optimum performance.

Several methods can be used to optimize the focal point, but I believe the best is W6IFE's "boomerang" system. This consists of a transistorized crystal controlled oscillator modulating a microwave crystal diode placed at the feed point of a remote antenna (Figure 2). The transistorized oscillator operates at ½ the communications *if* frequency, 30/2 Mc or 15 Mc in our case. The transmitting klystron radiates from the feed to be adjusted, toward the "boomerang" antenna. The CW signal, intercepted by the "boomerang" antenna, is AM modulated at a 15 Mc rate by the crystal diode. Thus, a signal containing the original carrier and two 15 Mc sidebands (which are 30 Mc apart) is reradiated back to the station antenna.

The receiver mixer detects the 30 Mc difference signal and passes it to the 30 Mc *if* amplifier and signal strength meter.

Since the detected signal is twice the "boomerang" oscillator frequency and the amplitude is proportional to both radiated power and receiver sensitivity, we have a

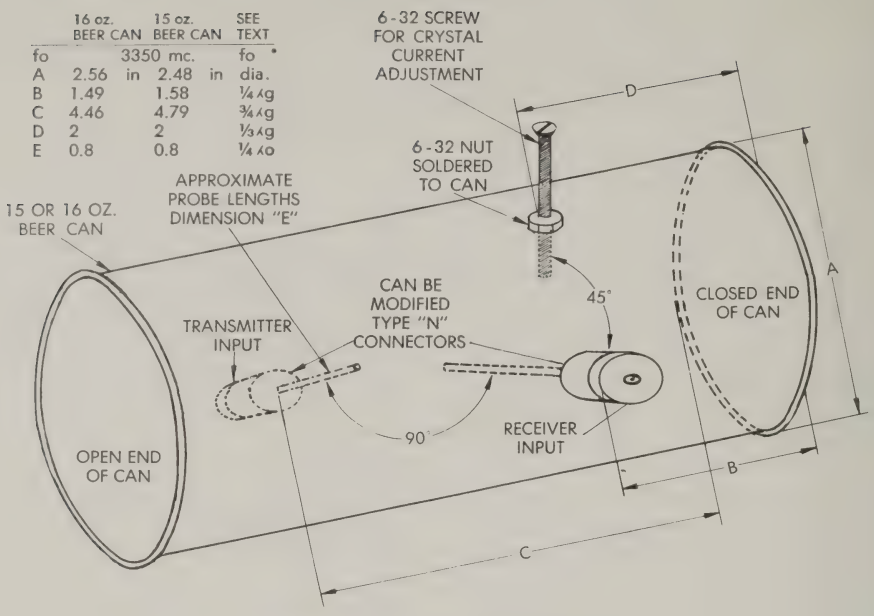


Figure 3. Polaplexer Construction Details

stable *if* signal that will indicate maximum signal strength when the feed is optimumly placed at the reflector's focal point.

When performing the above focal adjustment, the distance between the station antenna and the "boomerang" antenna, in feet, should be greater than 1.41 x 10^{-5} x frequency in Mc x reflector diameter in inches squared. For example: the minimum distance between the "boomerang" antenna and a four foot parabolic reflector at 3300 Mc should be 107.2 feet.

Dimensions for use of common 15 or 16 oz. beer cans for basic pola-plexer construction are included in Figure 3. For those energetic souls wishing to compute their own dimensions for this band or others, the procedure is as follows: Select a waveguide whose diameter in inches falls between 6917 / fo and 9035 /fo, where fo is the operating frequency in Mc, preferably closer but not equal to the later equation. This will assure that the TE11 circular wavequide mode will dominate and no spurious waveguide modes will exist. Then compute the waveguide cutoff frequency (fc) by equating fc = 6917 /dw, where dw is the waveguide diameter in inches. Now compute the guide wavelength, $\lambda g = 11803 / fo \times 1-(fc/fo)^2$. λg is the guide wavelength in inches. Now apply λg to the third column in the dimension table in Figure 3.

The use of type "N" connectors terminating the probes is not the only way to couple energy in or out of the pola-plexer. A 726A klystron, for example, can be mounted directly on the pola-plexer (see QST, Dec. 1957, June 1958 and Aug 1960) with an extended klystron probe directly exciting the waveguide. The receiving probe can be replaced by a mixer assembly within the pola-plexer. Many other modifications can be made to the basic pola-plexer dependent upon the availability of components and the cleverness of the individual.

Since it is necessary that the transmitter look at the other fellow's receiver, it is suggested that the transmitted signal polarization be 45 degrees to the right of vertical looking in the direction of transmission. This will eliminate the classic argument about who is to transmit horizontally and who vertically with the pola-plexing system. Also when you complete your 3300 Mc station, you can more easily communicate with me.

This should serve to acquaint you with some of the antenna techniques used on 3300 Mc and other microwave bands. If there is sufficient interest in these antennas or in the crystal controlled klystron "ROCK-LOC" systm in use by members of the San Bernardino Microwave Society, more can be published by prodding the editor of *VHF Horizons* via Uncle Sam's Postal Service.

Antenna Height

By Alan T. Margot, W6FZA
Communications Engineering Co.
167 Leggett Drive
Porterville, Calif.

Did you ever wonder why, on six meter E openings, the follows with the high antennas sometimes beat out those with the low ones, and sometimes vice-versa?

Did you ever wonder why some stations who do quite well on sporadic E take a back seat on tropospheric work?

I used to wonder too, and would set my mind at ease by muttering phrases like "ground reflections" and that old favorite "angle of radiation" and the like.

Recent efforts in the line of ionospheric scattering, however, drove me to the point where I felt that maybe these vague things could be put to use in actual communication instead of just as excuses for strange behavior of signals. A check of the available information on the subject in the ham magazines and technical periodicals yielded practically nothing.

Maybe everybody knew about those things so no articles were necessary. Everybody but me, that is. After a few well-guarded statements and questions I found, with relief, that we were all in the dark when it came to actual facts and figures concerning these matters.

Some plowing through the old textbooks revealed that the signal coming from an antenna operating in the general vicinity of the ground is the sum of the direct signal, and the one reflected from the ground. The reflected signal is slightly delayed due to the extra distance traveled. At certain angles from the horizon these two signals arrive in such a time-phase relationship as to add and double the field strength, and at other angles they can cancel completely. Doubling the field strength is a power gain of 4, or 6 db.

Determination of these angles, assuming good ground reflection, is pure geometry. A typical pattern for a horizontal dipole operating 4 half waves (39.4 feet on 50 mc.) over smooth earth is shown in Figure 1.

But, you say, "I don't use a horizontal dipole, I use a four element yagi". The vertical pattern in this case would be the product of the solid line and the free space pattern of the four element beam.

The result is to increase the size of the lower radiations, or lobes, and decrease the size of the higher ones. It does not, however, change the angles of the nulls and maximums at all. They are determined by the height of above ground alone.

Multiplying the solid dipole pattern of Figure 1 by the handbook pattern of a four element yagi yields the dashed pattern. Actually, the ground reflections will be something less than complete, except possibly over salt water, so full cancellation and 6 db reinforcement will not be achieved.

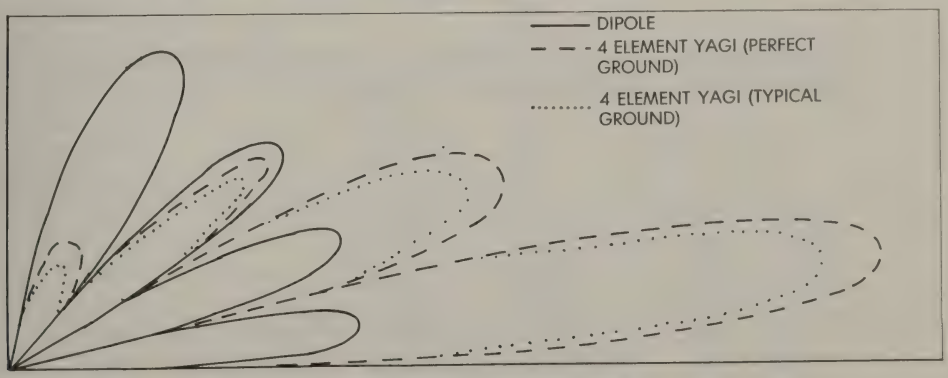


Figure 1. Dipole Reflection Angles

The ground reflections vary with type of earth and moisture content, but they are considerable even over the worst types of earth. Imperfect ground reflections might change the pattern further to look like the dotted lines of Figure 1. Pronounced maximums and minimums do exist, and if we understand what they do to us we can use them to advantage.

Since 50 Mc signals are reflected back to earth by the E layer of the ionosphere like a billiard shot, for every angle there is a corresponding distance where the signal returns.

Transferring these vertical patterns into actual earth distances requires slightly more complicated geometry because of the curvature of the earth. At this point, two variables are introduced: the effect of refraction, and the variable height of the reflecting layer.

The bending effect of normal atmosphere is known, and the upper and lower limits of the E layer are known, so two sets of calculations yield the chart of Figure 2.

The first figure in each spot is for a minimum layer height of 70 miles, and the second is for a minimum height of 50 miles. Because of the variable height of the E layer, there is no point in trying to improve the accuracy of this information. The chart does show some interesting things, however.

The chart also shows that we are donating a lot of power to space. Except in the higher antennas, only the first lobe is useful in VHF work. With horizontal antennas there is always one lobe for every halfwave of antenna height. This means that the fellow with the 70 ft. antenna (on 50 mc.) is shooting six useless lobes into the sky. The more directive the antenna, the more juice in the first lobe, hence the trend toward bigger antennas.

Note that there are a few cases that seem to contradict the old idea of getting the antenna up as high as possible. For example, from Figure 2, at 700 miles a 40 ft. antenna could quite possibly outperform any other up to 100 ft. Generally, it appears that the lower antennas can hold their own against the higher ones in average sporadic E situations.

Figure 3 is a similar chart for ionospheric scattering, based on an average scattering height of 50 miles. This height and the corresponding distances are for the center of the scattering region (36-60 miles). The scattered signal differs from the E reflected

FIGURE 2 PERFORMANCE OF 50 MC. ANTENNAS AT VARIOUS SPORADIC E DISTANCES E LAYER HEIGHT — 70-50 MILES

Ant. Ht. Halfwaves	Ant. Ht. Feet	−3db	0db	+3db	+6db First max	First Null	+6db Second max
2	16.68	1150- 920	1020- 780	830- 630	500-350	——	——
3	29.52	1260-1040	1160- 940	1040- 800	650-550	——	——
4	39.36	1330-1100	1240-1020	1120- 900	850-625	500-350	——
5	49.2	1350-1120	1280-1070	1190- 960	910-700	600-430	——
6	59.04	1390-1170	1340-1120	1240-1020	1010-800	700-500	500-350
7	68.88	1400-1180	1360-1120	1280-1050	1080-850	780-580	580-420
8	78.72	1420-1200	1370-1150	1300-1070	1130-900	850-625	640-450
9	88.56	1450-1220	1390-1170	1330-1100	1160-930	880-670	750-550
10	98.4	1500-1250	1480-1220	1360-1100	1180-950	925-725	820-650

FIGURE 3 PERFORMANCE OF 50 MC. ANTENNAS AT VARIOUS IONOSPHERIC SCATTER DISTANCES CENTER OF SCATTERING — 50 MILES

Ant. Ht. Halfwaves	Ant. Ht. Feet	0db	+3db	+6db First Max	First Null	For 6db angle Distance to Ground Reflection
4	39.36	920 mi.	850 mi.	590 mi.		320 feet
5	49.20	1000	920	700		495
6	59.04	1060	970	760		715
7	68.88	1080	1010	820		980
8	78.72	1100	1025	850	590 mi.	1270
9	88.56	1125	1040	900	625	1600
10	98.40	1150	1075	920	675	2000

one in that fragments of it arrive from all parts of the scattering region, while the E reflected signal usually arrives from one particular height in the E region.

Figure 4 is a plot of db antenna gain (relative to free space) against the very low angles from the horizon, for several common antenna heights. Sporadic E distances range from around 750 miles for 30° to about 1400 for 0.5°.

Of particular concern to the operator interested in long haul Es and tropospheric work is the performance of antennas in the 0.25° to 0.5° region. Energy radiated at these extremely low angles is bent to travel horizontally by refraction. The results of these curves are dramatic and obvious, and can be generalized by saying that you gain approximately 6 db in a horizontal direction every time you double the antenna height.

The man with the 100 ft. tower is almost 15 db better off shooting horizontally than the one with the same antenna just off the roof. No wonder the high antennas work all the groundwave DX! And this advantage continues up to over 32 halfwaves high (300 feet at 50 Mc) if we neglect the effects of line losses.

These advantages would not be wholly realized if (1) you were shooting over hills nearby, (2) there were abnormal bending conditions, or (3) the path were line of sight. Bear in mind that the ground reflections that form the 0.5° radiation angle occur about 115 times the tower height away from the antenna!

There are other important reasons for getting the antenna up in the air. Useful energy is absorbed from low antennas by surrounding objects. Gain antennas depend on phase relationships of the currents in the various elements, and reflections from nearby objects can induce currents which upset these relationships. A perfectly good antenna can give a queer pattern when mounted too low. These factors are difficult to analyze quantitatively, but antenna handbooks always suggest that antennas be mounted "free and clear" of surrounding objects.

The information in this article just scratches the surface of this interesting subject. If any reader desires more information, or solution of a particular problem please communicate with me. If you hear me on six and my signal is weak, it's probably one of those darn nulls again!

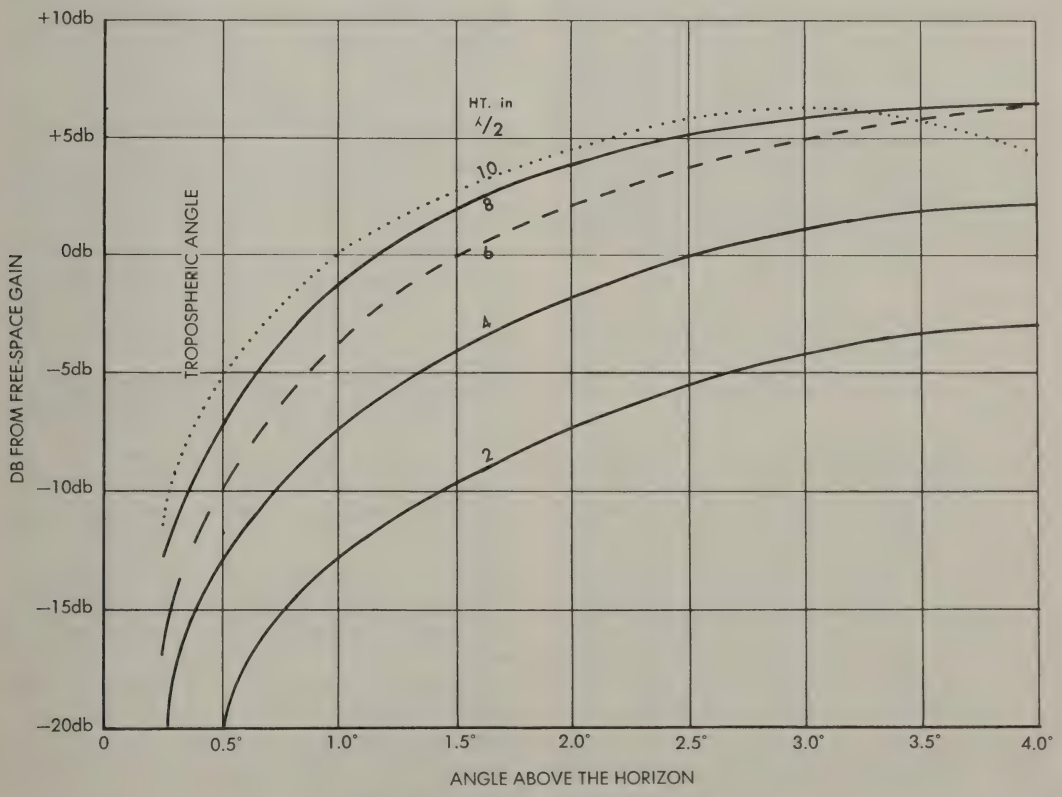


Figure 4. Antenna Gain at Common Heights

Salvaging Old TV Rotors

Every VHF antenna in practical use must have some means for rotating it — and it's here that many constructors run into a big problem.

If you're willing to go out and spend a hundred dollars or more, there's no problem at all. The CDR HAM-M model, a couple of Telrex jobs, and one made by Johnson all serve admirably in the upper price brackets.

Less expensively, a number of TV rotors which will handle medium-size 6-meter beams, fairly large 2-meter arrays, and all but the most gigantic of antennas for higher bands can be bought for between $15 and $50.

However, that's still a good-sized chunk of cabbage for those of us who must cut our hamming budget as thin as a Harvey House ham sandwich!

Fortunately, there *is* a source of supply of rotors for $5 or so if you just take a little extra time and trouble.

This source is born in the fact that most home TV-pole installations are not the best, from a mechanical-engineering standpoint. Comes a good-sized wind, and down falls the pole.

When this happens, the antenna ends up as a tangled mass of tubing — and the insurance adjustor comes in and writes the whole set-up off as junk.

Usually, in such an event, the rotor survives the fall. But knowledgable TV repairmen snaffle off the good rotor-control head pairs which show up by this route. The ones left for us hams usually consist of only a rotor mechanism, sans control head or instructions.

Most people pass these by — and when they do, they pass up a bargain. Because almost all TV rotors operate in much the same manner, and it should take you no longer than 15 minutes to put any rotor back in service (less time if you have a control head, even if it doesn't match the rotor you have).

Virtually all TV rotors operate on 24 volts AC, using the split-phase principle to give you direction control. This means that a simple control head consisting only of a 24-volt transformer, a DPDT-center off or a DP3T switch, and a big capacitor will work with any of them.

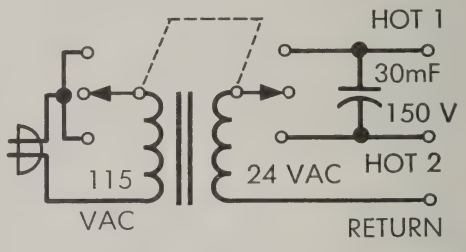


Figure 1

Note that the control head (schematically shown in Figure 1) has only three output wires. Most rotors have from 4 to 8 wires in the control cable. The other wires are for position indication — and that's something this salvage control unit won't help with.

Most practical approach to the problem of position indication is to use a synchro (generally termed Selsyn, though this is a trademarked trade name) system to drive a pointer at the control location.

To determine which three of the wires coming from the rotator you should connect to, take your trusty ohmmeter in hand and measure the resistance between pairs of wires.

Eventually you should come up with three wires, two of which show a low (20 to 200 ohms) resistance from each of them to the third wire, with just twice that resistance reading between the two themselves.

These two wires are the two motor "hot" windings, while the third wire is the "common" motor return. The two wires connect to the two ends of the capacitor, while the third wire connects to the remaining terminal on the control head. If you find the rotor turns the wrong way when you operate it, reverse the connections of the "'hot" wires and it will reverse. **—K5JKX**

1296 Mc . . . from p. 15

Recently, the log-periodic type of drive has been tried with excellent results. The log-periodic antenna by itself is not much for the amateur, but placing it in front of a square-corner or a good parabola produces a *fantastic* array. The six-foot dish pictured with the log drive stays within 30 to 80 ohms and holds a good pattern from 400 Mc through 2500 Mc!

All forms of dipole antennas are based on electrical length of something, but a log-periodic antenna is based on proportion and angles, not finite lengths. Theory is non-existent in practical form, but certain kinds of log-periodic antennas are capable of uniform patterns and impedances over 100-to-1 frequency ranges. 10-to-1 is easy! They can be fed with open-wire or by use of a common form of balue from coax. See Figures 2 and 3 for one very crude version; this is the broadest-band antenna with gain that it has ever been my pleasure to work with. Log-periodic antennas can be readily scaled up or down in frequency, and of course the parabola works from audio frequencies up . . .

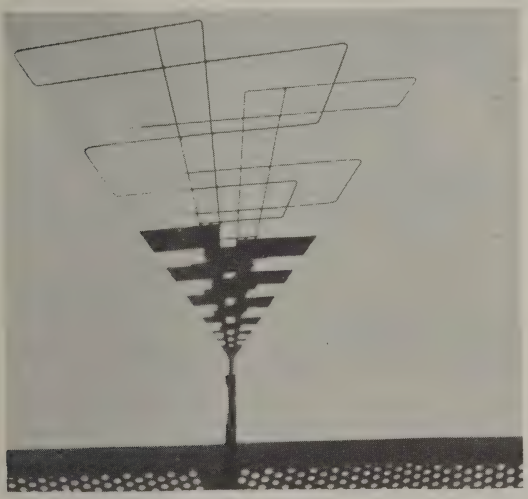


Figure 3

The other photos are of the alt-az mounting using one good rotor and two TV types sawed off and mounted by angle brackets on top of the first. This makes a rugged, easy mount that will handle a counterbalanced six-foot dish with ease. By parking the dish straight up when not in use, no wind problem is encountered, even at 70 feet!

Any high-gain antenna with less than 10-degree beam width should have electrical elevation built into the mounting. Plus or minus 10 degrees of tilt, controllable from the operating position, makes a world of difference on local contacts, and if you are going to do that, make it from minus 10 to plus 90 degrees while you are at it. If any moon work is contemplated, start by building a good Polar mount. Failure to believe this has cost me three years of hard work — I believe it now! Without a motor-driven, accurate Polar mount, you are just wasting everyone's time and effort.

This could go on and on, but once you get interested you will find a great deal has been written about antennas. The VHF handbooks detail the common types and periodicals leak out info on the exotic ones. All are of interest when you reside above 1000 Mc.

—K2TKN

Figure 4. Dual Rotor Arrangement

Figure 5. Dish is Parked Straight Up

VITAL HAPPENINGS & FACTS

OPERATING AND DX NEWS

HEARD IN FLORIDA

Remember the VHF contest sponsored by the League back in June? Were you on six meters around 1800 CST (1900 EST)? Perhaps you heard W5KHT announcing (in a somewhat quivering voice) "QST-QST to any two-meter equipped stations . . . it appears that two meters is open in Florida and the Carolinas from Oklahoma. We are tuning 144 to 145 megacycles at this time at W5KHT. Anyone want to try it?"

The 50 Mc operator was 5KHT, Coop. An old hand at sporadic E propagation, Bob detected what he thought sounded like skip sufficently short on 50 megacycles to support a 144 megacycle path of around 1,000 to 1,200 miles in a line to Florida and the Carolinas.

Russ, W5HCX, had the contest rig on two meters at the time, calling CQ. The peak in Es ionization on six meters lasted approximately 30 minutes, from 1745-1815, according to the contest log. On 50 megacycles we were working Arkansas and southern Missouri at the time (300-400 miles) with outstanding signals. We heard stations in Tennessee working stations in Florida and the Carolinas.

No station answered our calls on 50 megacycles (skip was apparently so short as to shut us out of Florida and the Carolinas) and Russ, W5HCX, was having nil luck on 144. At 1755 CST he called and worked W7JCU/5 portable in Oklahoma City.

And we forget about the incident because there had been many-many other "it looks good for 144 megacycles Es occasions" in the past, which did not pan out.

Recently we received a letter from John, K4IXC, of Melbourne, Florida. Melbourne is on the eastern coast of Florida, approximately 90 miles south of Jacksonville.

It began "Dear Bob — On June 9 (at) about 1855 EST on 144.208 Mc I heard a phone signal which I identified as W5THT. Not finding this call in any callbook, I assumed I had made a mistake. He gave his QTH as Oklahoma City, and was calling a W7—/5. I was so surprised I didn't make a note of the W7 call. Recently in talking to WA4DRJ your call was mentioned in connection with VHF Horizons. I then remembered this incident and realized I could have heard W5KHT, and mistaken the call. If it was you, I know you will be interested in this report. The signal was about S-1 when I first heard it, building up to S-9 and then fading down and out. I heard your call 2 or 3 times in the space of about two minutes and had time to set my VFO on your frequency and call between your breaks. I used both phone and CW. No luck. That is my story. Could it have been you?"
Sob.

It could have been W5KHT. It seems rather likely it was. Our operating frequency was 144.208 megacycles (on the nose no less — you must have *some* VFO calibration, John!) throughout the contest.

How did we miss K4IXC? For one thing, we were not listening on our own frequency, nor were we VFO.

John's 100 watts on phone might not have made the grade but his 800 watts CW surely would have. Operator Russ (HCX) says he promises, on a stack of 7788's, to *always* check his own frequency in the future when E skip on 144 megacycles seems possible! That takes care of next time. But who will ever forget how we missed Florida on E skip *the first time?*

As with any event of this type, there is at least one lesson to be learned. Many 144 Mc men expected E skip on two meters this summer. It looked like "the year" for it to happen. To the best of our knowledge, this report is the only one for the season that even smells of E skip. But we know, from our logbook of the past summer, that even from our own limited baliwick, we heard five different occasions when E skip got down to the 350-500 mile range on 50 Mc. Any textbook will tell you that assuming a

normal E cloud formation, this is sufficent intensity to support a 1,100 mile 144 Mc path.

So where was everyone who operates 144 this summer? Sleeping, we suspect. Or tied up on six meters. Whatever the case, VHF hopes to explore this subject in considerable detail in the winter ahead. Maybe next summer more of us will be aware of what it takes to work E skip on two meters. Even the best of us need a state or two in the 1,000 to 1,400 mile range.

50 Mc foreign leads off this month. September - October is traditionally the period of the year when we are led to expect at least a few openings into the far-north land. VE8BY (50.040) has been known to come through in southern Canada and the northern States. Now we have detailed word from Jack Reich, KL7-AUV, concerning operation of not one, but two stations in the Artic Circle. KL7FLC can be found on 50.045 megacycles. FLC is located on Arlis 2, at a position 81 degrees north, 163 degrees east. This was his location in mid-August, and it is assumed that with winter coming on, he won't have moved much in the interim. This is roughtly 1500 miles from Anchorage, according to KL5AUV.

The operator's name is Bob, and he has been on the air and running a keyer since May. Also on from the Artic Circle is KL7-FLB, operated by Bob Mellen. This is Fletcher Ice Island, known as T-3. The KL7-FLB frequencies are 50.040 and 50.112. Those wanting to write to Bob can direct their mail to "Artic Research Laboratory, Pt. Barrow, Alaska," All of KL7FLB's contacts have been from 0400-0800 GMT to date. KL7AUV advises that he himself is operating his code wheel on 50.084, 200 watts CW. Regular schedules are maintained 0400-0435 GMT for VE8BY, KL7FLB, KL7FLC, KL7AUG and KL7AJ. AUG and AJ are located in Ketchikan and both have recently been helping a great number of W7, W0 and W6 stations to Alaska. Just in case you hear the KL7AUV code wheel on 50.084, Jack's telephone is FA-2-2950 in the Anchorage exchange. It can be direct dialed from most of the 48.

KL7FLB has been working KL7AUV, KL7ECT (Ft. Greenly) with KL7FLC also getting into the act.

From way down south, VHF'er XE1CZ writes "I have been working 50 Mc for 5 months now and have made contact with about 350 different stations. This includes LU, CE, CO, K-W's, KP4's, XE. I have confirmed 25 states and worked 30 to date. I'm the only station working VHF in Puebla, which is located 80 miles SE of Mexico City. Altitude above sea level is 7,200 feet. I also work 2 meters (9 element yagi and a pair of 6146's) and 432 megacycles (10 element beam, crystal converter). My six meter rig runs 50 watts to a 6146, and my antenna is a homebrew two element quad."

50 mc SSB enjoyed a heyday during the Perseids shower (reported in considerable detail for the two meter buffs, elsewhere in this issue). WOPFP took the occasion to catch W5KHT on forward scatter (or meteor scatter) over the 590 mile Ames-to-Oklahoma City path. After exchanging the usual formalities on both August 11 and 12, the two agreed to have at it 0730 CST on 50.110 Saturday mornings in the future.

K4VZU, Alton Morgan, sets us straight on who is operating 50 Mc SSB from Alabama. Al writes "W4JMS, K4UTH, K4LSK, W4CIN, W4ZQM and K4MBM are active currently, "as is he, K4VZU. Take W7UBI off of your active list for SSB. Those that have Keith's Idaho SB card for 50 Mc can count their blessings because it may be awhile before we get anyone to replace him going. Keith became W7UBI/0 in Warrensburg, Missouri in August, where he will be for at least 18 months. No SSB activity is planned however, because the 4-400A power supply was left behind in Idaho. Come on, Keith, don't let a little thing like that stop you!

W7ZQX continues his SSB scatter schedules with the California crew on weekend mornings. George represents the sum total of SSB stations known to be active from the state of Washington. Maybe some of the gang will take heed of last month's issue of VHF and get abuilding during the winter months ahead.

50 mc fone has a strange spell over it. The shock resulting from a sudden drop off in E skip openings has caused a numbness to set in and everyone frozen at the mike! Few still realize that off-season E openings are frequent visitors throughout the country, especially on east west paths south of a line from Norfolk, Virginia west to San Francisco. Watch

those early evening periods. They can be real producers of DX!

K1PDA, Manchester, N. H. found six open from 2310 to 0200 on the 14th-15th of August. The opening was to the west for Dave, with VE4MA, Winnipeg, Manitoba worked. Dave heard K9SSU working VE2-MJ and worked W3BWU and K3ADZ in Western Pennsylvania on short skip. Also heard were many stations in Minnesota and 4, 8 and 9 land. The Manchester lad has 29 states and 1 Province worked. He is looking for 3 of the zero states, all of the 7's, California, the 5's and Maryland and Deleware. Seems that a lot of the western boys should need New Hampshire too, Dave. Just announce where you are when the band opens out that way, and stand back. Gravity should take care of the rest!

144 mc news this month falls in the Perseids department, and the report of E skip reception, both covered elsewhere in this issue. In other than meteor burst land, tropo bending continues to make news, with the likelihood that much more ground wave news will be made as this is read.

K4IXC, Melbourne, Florida has a pair of 4X250B's coasting at 800 watts on two meter CW, crystal on 144.090, or vfo as the need arises. The antenna is a 30 foot long yagi on a crank-up tower which can climb to 100 feet! The converter is a 417A mounted at the top of the tower, with only the *if* output signal coming down the cable to the 75A1 receiver in the shack (Now there's a good idea!). John reports regular schedules with W8QOH/MM who plys between New Orleans and Fall River, Mass., around the cape of Florida and on up the eastern seaboard. Schedule times at 0655 and 2100 EST on CW. Results to date show all-overwater path to 460 miles is no difficulty. IXC has worked QOH/MM several times out to 550 miles in the Gulf, and in the Atlantic, off Cape Hatteras. The skeds run from 20 minutes to a half hour. With W8QOH/MM off the coast this fall, during the annual fall inversion season, a number of interesting contacts are bound to result. His frequency is 144.078. When QOH is out of tropo range for K41XC, the pair continue skeds using meteor burst techniques, 15 seconds on and 15 seconds off. K4IXC is very interested in setting up skeds for the coming fall showers. Those interested can contact him at Rt. 2, Box 684-P, Melbourne, Florida.

Several Florida VHF'ers report the passing of W4DPD of Lake Wales, Florida. The central Florida gang feels this loss as the passing of a friend liked by all, and an avid VHF'er from years ago.

Southern Technical Editor Paul Wilson, W4HHK, noted a new two meter SSB station now active near Huntsville, Alabama. K4ZQM is running a 20A exciter into a home-brew converter ending up with a 4X150 final on 144.102 megacycles. Look for him.

Barry, W4TLV, also reports from Alabama that the night of August 10th was a hot one for the gang in his area. The band was open on tropo into Wisconsin, Michigan, Illinois, Indiana, Kentucky, and Ohio. A 432 megacycle try with W8PT in Detroit proved no good. This was the first north-south opening in some time, according to Barry.

220 mc activity is apparently poor only outside of the larger centers of population. W2SEU reports considerable activity in the New Jersey-New York area. Fred reports W2IQR, W2AOC, W2WOF, W2HVL, W2NTY, WA2IFP, K2IQR, K2-IPC, K2DZM, K2AXO, W1NOC, W1MFT, W1AJR, W3CGV, K3IUV and W2SEU active. Fred is currently stationed in Massachusetts but as he notes (as of August 8) "just 317 days until I am out . . . and then watch out!" For the time being his 100 watts into a 22 element beam 55 feet up loads up on 221,400 Mc only on weekends.

W9OVL reports 220 activity is not exactly missing in Chicago. Some 50 stations are active according to Ben, with most of the activity concentrated around 2000-2100 EST Mondays, Wednesdays and Fridays. Ben runs 20 watts for local contacts and 150 watts for DX. He has worked as far west as Omaha during tropo openings, and suggests that those stations outside centers of activity run at least 60-70 watts into a decent beam to be heard.

REPORTING TO VHF

A change in printing dates and deadlines resulted in this column being shorter this month than usual. Dozens of good reports arrived after our *new* deadline, the 23rd of the month. Drop us a note with news of operating and DX in your area. We would all like to see your contributions monthly!

Perseids Report

Although results varied from area to area, most Perseids meteor shower reporters would agree that this year's event was good drill for all involved. A number of 144 megacycle DX enthusiasts added new states and all had an opportunity to put new equipment through its paces.

Comments from actual 144 Mc participants varied from Ernie Brown's (W5FYZ) "This seems to have been the best Perseids shower for the past three years . . ." to W6WSQ's "In general a very poor shower."

The table accompanying this report breaks down some of the results reported up to press time by shower dates and time of contacts. In this case, times are in CST since the majority of path-midpoints were over the Central Time zone.

Our table indicates that things just didn't start happening until the 11th this year. The vast majority of contacts reported occured beween 0200 and 0700 CST, although one occured as late as 1020 CST (W6WSQ to K7IDD on the 12th). Several stations reported hearing strong bursts from other stations, on schedule, in the 2000-0000 CST time period (W5JWL heard bursts from W1JDF, etc.) but bursts were apparently too far between during the evening hours to make a QSO work.

Pure north-south path QSO's and reports of bursts heard concentrate in the 2300-0200 CST time segment. More slanted paths, *i.e.* SE to NW, SW to NE, etc., occured in the 0200-0600 CST time segment for the most part. Due east-west paths varied from W6WSQ to K5TQP in the 0200-0300 CST segment on the 12th to W4VHH-W5FYZ in the 0500-0600 CST segment on the 12th and W4WNH-W0EYE in the 0500-0600 CST time segment on the 13th.

The table does not tell the entire story however. As with any super-human effort (and any participant in the wee-hour Perseids will tell you it is just that), it is the minor things which really make the story complete. They seldom seem minor when they are occuring!

W5FYZ (Minden, Louisiana) reports "copied W5JWL skedding K5TQP, New Mexico with both stations heard well. K5-TQP had several 20-second bursts. Also copied W5KXD, Dallas, skedding W2AZL, New Jersey. Both stations copied including several 5-second burst from W2AZL making identification easy. While working K2LMG I was worried with Perseids QRM! Carl, W2AZL was on 144.013 and Dave (LMG) on 144.014. On a ping or short burst I would hear K2LMG first followed after about a second with a burst or ping from W2AZL. On sustained bursts they were both in there banging away and QRMing each other. I use a 2.4 kc bandpass in receiver in MS, so could hear them both throughout schedule. W7JRG surprised us all with the consistent signal he put into this area. Good, solid QSOs were the order of the day with extra 73s gms and sks thrown in for good measure." The W5FYZ 144 Mc total is now 33 states, 9 call areas and VE3. Ernie guesses he will have to wait for Echo A12 to work W6, his 10th continental call area.

W6WSQ, West Covina, California felt there was a definite peak on the 12th (our table would seem to verify this) with a slight drop off on the 13th. The NE-SW paths were particularly poor, according to our West Covina reporter. Don also copied a 90-second burst (!) at 0758 on the 12th from K7IDD during the Utah station's tune-up, seconds before the sked began. The 90-second burst was strength 6.

W4WNH, Elizabethtown, Kentucky found the 1962 Perseids a trial by tribulations! Shelby had one equipment problem after another including a broken quarter-wave matching transformer on his 32-element array, and a snapped feedline (one after the other). This didn't keep him from putting in one of the star performances however. Shelby was running his 5-year-old 829-B loafing along as usual at 400 watts input (that's what he said!), the aforementioned 32-element array and a 6CW4 pre-amp into a crystal-controlled converter and 75A3 with audio filter.

He notes (on his contact with W0EYE, Boulder) "On the 13th it was all over (successfully) at 0651 EST. Five pings, 6 short

1962 PERSEIDS METEOR SHOWER RESULTS

Time—CST	August 10	August 11	August 12	August 13	August 14
2300-2400		W4WNH hrd WA4DRJ			
0000-0100			W76H6 hrd W6YX W6WSQ hrd W7MAH		
0100-0200			W4WNH hrd K4IXC	W4WNH wked K4IXC W4WNH hrd K7HKD	
0200-0300	W5JWL hrd W7FGG		W5JWL W6WSQ hrd W7LEE wked K5TQP W3TDF hrd W5PZ	W5JWL hrd W7LEE	
0300-0400	W5JWL hrd W6WSQ	W5JWL hrd W6WSQ	W5JWL hrd W6WSQ W7JRG wked W5RCI	W5JWL hrd W6WSQ	W5JWL hrd W6WSQ
0400-0500			W5JWL hrd K7IDD W5FYZ wked W7JRG	W5YZ wked K8AXU	
0500-0600	W4WNH hrd W7JRG	W7JRG wked W5RCI	W4WNH hrd K7HKD W5FYZ wked W4VHH	W4WNH wked WOEYE	
0600-0700		W5FYZ wked K2LMG	W4WNH hrd WOEYE	W5JWL wked K5TQP W2AZL wked W5KXD	
0700-0800	WZAZL hrd W5KXD	WZAZL hrd W5KXD	W2AZL hrd W5KXD	W5JWL hrd WA2EMA	
Miscellaneous			W5JWL W6WSQ hrd WIJDE, wked K7IDD 2000-2100; 0900-1020		

bursts and 3 slightly longer ones; the best being long enough for an exchange at 0650:30. My third QSO with Colorado, all MS."

Shelby's QSO with K4IXC was detailed this way. "Not having previously known about his operation, he was called via land-line on the 11th and skeds set up for the rest of the shower. On 12 August during his sked with K9UIF (0100-0200) he had some extremely strong bursts. I waited. Came 0200 EST and my sked, he all but vanished. There were plenty of pings and even a few short bursts. But they were SO weak! But it took only 31½ minutes on 13 August, with several bursts, to set things up, concluding at 0231, almost exactly like the W0EYE contact. This was a new state for each of us."

Shelby never heard W7JRG during their sked, but the Billings station was heard "on the 11th during most of two 30-second calling periods when he was skedding W5-RCI. This was the longest burst heard . . ." during the Perseids. K7HKD (Wyoming) was the most consistent station heard in Kentucky by Shelby, although no good bursts were copied. Plenty of pings though, whenever K7HKD was transmitting, or so it seemed.

W2AZL, Plainfield, N. J. kept at it with W5KXD, Dallas, starting with schedules at 0700 CST on the 10th and running the same time period through the 13th when they switched to 0200 CST. The 13th schedule ran from 0200 CST through 0643 CST when long bursts exchanged all of the required information. W2AZL also maintained skeds with W0QDH (Kansas) and W0EMS (Nebraska) and W0IUF (Colorado). Results were nil.

W3TDF maintained his schedules with W5PZ, Oklahoma. Starting on the 10th the sked ran through the 14th. Pings were heard on the 10th and 11th, while a complete ident was copied at 0218 and 0253 on the 12th. The 13th was nil, and W3TDF assumes the Oklahoma station did not make the sked. On the 14th several pings were copied, and a complete ident at 0256 CST.

Schedules between W3TDF and W5KXD led TDF to wonder if KXD's 144.140 frequency might not have been closer to 144.-137. TDF heard W2AZL calling W5KXD on the 13th, apparently during his sked period with the Dallas station. This was during the extended period of the 13th when 2AZL and 5KXD were running most of the night up to 0643 CST. W3TDF's schedule with W0QDH proved fruitless.

W5JWL had skeds with W7FGG in Arizona 0230 to 0300 CST on the 10th, and the Arizona station was copied very well in Gurdon, Arkansas, according to Jay. How-

COMING IN NOVEMBER'S VHF . . .

We have a whole batch of goodies lined up for next month. Naturally, we don't want to tell you about all of them right now, but here's a sampling of what to expect from VHF in November:

**** The Little Feller***

Want to go 6-meter sideband (single!) the quick and easy way? The Little Feller uses four tubes plus power supply, is omplete on a 10x12x3 chassis, and gives you about 10 watts out—all for less than $100 even if you buy all parts new!

**** More About Antenna Height***

W6FZA's of antenna height effects on 50Mc (this month) set us to thinking. The result is a 4-page Staff Report on the subject!

**** A Lazy Linear***

This project is a do-it-yourselfer especially for Heath Sixer owners; it makes a "medium-sized" rig out of the Sixer at a most nominal cost (most of the parts are probably in your junk box) and can also be used to good advantage as a 100-watt final for The Little Feller.

**** How Many DB Is Enough***

John Chambers, W6NLZ/A6NLZ, has a question to ask this time — and it's a most pointed one.

**** 1296 Mc Antennas—the West Coast Story***

Don Goshay, W6MMU, presents a roundup of ham-microwave antenna knowledge from the West Coast viewpoint.

**** And much, much more is coming your way in November.***

HAVE YOU SUBSCRIBED YET? DO IT NOW!

Place
Stamp
Here

TO:

From a VHF Horizons Reader!

DEAR VHF

Below are listed a few of the VHF-UHF operators in my area. These fellows probably haven't seen a sample copy of VHF yet. How about sending them the full story?

ANNOUNCEMENT

The best way to get a bigger and fatter exclusively VHF and UHF magazine is to persaude a few more manufacturers that they should be showing off their products here monthly. A few more advertisers and we can begin thinking about adding more pages. The card below, perforated and ready to tear out, should be addressed and mailed to one of the three manufacturers listed here. Obviously, the more cards sent to manufacturers, the greater the possibility that VHF will receive a fair share of their advertising budgets. And the bigger VHF will get!

Send card to:

Mr. Petersen
Petersen Radio Co.
2800 W. Broadway
Council Bluffs, Iowa

Mr. Cliff Edwards
The Heath Company
Benton Harbor, Michigan

Mr. Stan Issacs
Lafayette Radio Co.
P. O. Box 10
Syosset, L. I.
New York

Dear OM:

I picked you to send this card to because I think you should be advertising your products in VHF Horizons. This new magazine is _____fair _____good _____excellent for us VHF-UHF radio operators. The mere fact that it is exclusively VHF-UHF makes us very loyal supporters.

73,

_____ City, State

_____ Call

ever W7FGG had to break off skeds abruptly at 0300 because of illness. W7LEE, in his new location above Parker, Arizona was a near-miss for W5JWL. Jay reports "heard lots from Parker but just couldn't get the final "R" through. Signals were quite strong peaking S5-S6 with bursts to 20 seconds or so." W5JWL's sked with W6WSQ resulted in a few pings 0330-0430 over the 10th to 14th period. "Apparently this is stretching distance some . . . and 16 db gain antenna on this end needs some improvement" noted Jay. W5JWL also notes "Sked with WA2-EMA 0700-0730, almost had QSO on the 13th but had to rush off to work and was unable to continue. Another 5-10 minutes and we should have made it. Signals peak S4."

Jay had W4WNH type troubles too. A tuning capacitor went up in smoke (strange, isn't it, how this always seems to happen during a maximum effort period?) and took a 4X250B, or a bad 4X250B took a capacitor. Jay also had antenna rotator trouble which gave false bearings. But, as he notes, "Outside of this, some arc-over in the HV supply and a little line noise, everything went smoothly!"

W7LHL had a single sked with W0ENE, August 10-13, from 0100-0200 CST. Ernie didn't hear anything from the Omaha station. Ernie did copy a 20 second burst from W6YX (Stanford, California operated by Vic, W7QDJ) when YX was running a CQ wheel on a W7RT sked.

W5RCI's contact with W7JRG resulted in the 38th two-meter state for the Marks, Mississippi two-meter pioneer.

W7JRG put his brand new W0MOX design two-meter final to work for the first time this year. In addition to working W5-FYZ, W5RCI and W0BFB (Iowa), Ken heard W0EYE on August 9, 10 and 13 (". . . should have worked him," noted Ken). Skeds with W8KAY, VE3DIR and W4WNH produced no pings or signals. W7-JRG has 15 states now on 144.

W4HJQ, Kentucky, was kept out of the shower by feedline problems.

144 Megacycle Operating Frequencies

WA4DRJ	Florida	144.008
K4IXC	Florida	.089
K7HKD	Wyoming	.124
W7JRG	Montana	.008
W0EYE	Colorado	.048

(Courtesy W4WNH)

Meteor Scatter

by Raymond P. Bilger, W3TDF
Harthorne Avenue
Langhorne, Pa.

Although I haven't participated much in Meteor Scatter work, I have been observant of the operations of others. The more I hear, the more convinced I am that many are wasting their time. There is a very dire need for a standard practice. The following views may put Meteor Scatter propogation into the scientific class, but then we wouldn't be on the VHF bands if we weren't more scientifically inclined than the average ham.

The ARRL has, through Ed Tilton and his column, expressed the opinion that the absolute minimum requirements for a contact are, (1) positive identification, (2) swapping of signal reports and (3) the Roger. The positive identification, in this humble one's opinion, is that you must hear the other station call you and sign his own call. The signal report needs no explanation for normal purposes, nor does the Roger, except that the Roger should not be sent until all the necessary information constituting a contact has been received. For Meteor Scatter work these requirements still hold true but can be accomplished in an absolute minimum time if both stations agree upon and use a common system.

Many stations have been observed sending S1 and S2 to indicate that they have received pings or a short burst. This is an unnecessary and fruitless waste of time. If, for instance, you are sending a complete set of call letters (those of both stations) and 10 reports of S1's. The fellow on the other end has heard nothing but a couple of pings up to now and then receives an 8 second burst of S1's. In those 8 seconds he could have received a complete set of call letters! Yet, since he received only a batch of S1's, it means nothing more to him than the fact that you have received several isolated pings from him. (Assuming that you are using transmission speeds of 25 to 30 WPM, it takes only 5 seconds to send a set of call letters broken by 'de'.)

Assuming that the signal report should never be sent until positive identification is established, which after all is only ethical, the receiving station, having received an 8 second burst containing a complete set of call letters can now begin sending a signal report (a true signal report), interspersed with the call letters. On the other hand, since he only received a batch of S1's, he has no way of knowing who sent them or to whom they were being directed. Result—one good burst wasted!

Another fact which I would like to bring to light is the assumption of at least one MS enthusiast. It was his thought that an S2 should be sent indicating a short overdense burst was received, but not necessarily containing any positive identification. (It could have been 8 seconds of S1's). However, if later in the schedule he receives a full set of call letters and S2's he enters in his log an S2 as his signal report. He has sent an S2 to indicate reception of a burst but containing no valuable information, yet on receiving that same S2 he considers it as a signal report. How can a signal report and some other explanation be tacked onto a single symbol?

One system which has been endorsed is sending a Roger to indicate you have received a full set of call letters. Then, and only after both stations have received and rogered for the calls, they begin to send signal reports, which also must be rogered separately. Then comes the ultimate of confusion, 'The Roger of the Roger.' This sort of thing can go on forever!

The prize that most of us look and hope for is a burst of 20 seconds plus, starting between 5 and 10 seconds before the end of station A's transmisison. If station A has been sending calls only, then station B will have received a full set of call letters and will then send one complete set of call letters, one signal report and BK. Station A then comes back with a Roger, one signal report and BK. Then station B comes back with a Roger and you've got it made. If the burst lasts any longer you can try to get through other information.

Assuming that both operators are using 25 to 30 WPM and can work fast break-in the burst must last 12 to 13 seconds after the change of transmission, *i.e.* after the start of station B's transmission in the

case above. This cuts the absolute minimum length of the overdense burst to 17 to 18 seconds for a completed QSO. This is exactly how W4LTU and I made our contact during the Geminids shower on Dec. 14th, 1956. The total burst was 27 seconds long and started about 10 seconds before the end of Walt's transmission. I even got a '73 es Tnx' through before the burst died.

We all want to work more states and the fellow that comes up with 40 on 2 meters first is going to be one proud peacock. I doubt very much if it will be a coastal station, unless we get one of the rare gems that gave that deserving fellow, Tommy, KH6UK and W6NLZ the record. If we intend to use MS propagation (if it can be termed propagation), we must make use of every burst that is long enough to contain any information at all. Therefore we must agree upon and very diligently use a system which is designed for 'getting the mostest from the leastest.'

The greatest asset to anyone using MS is the automatic keyer. I use a 6AQ5 clamp tube to control the driver screen. The driver has no bias other than that developed across the grid resistor. The 6AQ5 is biased beyond cutoff and a plate relay in the plate of a 6AC7 (any reasonable tube can be substituted) shorts the bias out on the 6AQ5, through a resistor arrangement so the actual bias supply is not shorted out. The 6AC7 and 6AQ5 use separate supplies so that the 6AC7, which is also biased to cutoff, can be keyed without having the driver screen voltage on the key. The 6AC7 bias is applied in a special circuit in which there is also a tone rectifier. I use a tape recorder with a loop of tape for auto-keying, feeding the output through a small output transformer into the one rectifier. The key is left in the circuit at all times and all that is necessary to change from auto-keying to hand keying is to cut the volume on the recorder, or stop it. As a matter of information I use a second tape recorder for complete recording of all schedules.

Regardless of the system used for auto-keying, it should be set up so that the hand key may be used in place of the auto-keying on a split second's notice. Suppose, like myself, you leave the auto-keyer running continuously and merely turn the rig on and off at the appropriate times. Then at the very end of the other station's transmission you get a ping. This could be the beginning of an extended burst. Therefore you go back on manual and give one complete call and a BK. If the other station doesn't break-in within 3 or 4 seconds then you go back on automatic. As pointed out before, you must make use of every available opportunity to get through information and take advantage of every overdense burst that may come along.

My proposed system is quite simple once you get on to it, but requires that you be on your toes to transmit only that which is necessary at each and every stage of the game. First you transmit full sets of calls over and over, (ie. W4LTU de W3TDF W4-LTU de W3TDF etc.), on each transmission. Then, and only after you receive a full set of call letters from the other station do you include a signal report. The signal report will be taken up later. When you do begin to include the signal report it should be thus, W4LTU de W3TDF S3 S3 W4LTU etc. This sending of the signal report is your information to the other station that you have received his full set of call letters. When received by him, it tells him he need not send the calls anymore and can send the signal report and a Roger, thus R S3 R S3

When you receive	You send	Sig Rpt	Meaning
Nothing or incomplete calls	Calls only	S1	Up to 5 Sec.
Complete calls	Calls & Sig Rpt	S2	6 to 10 Sec.
Calls & sig Rpt.	Sig Rpt & Roger	S3	11 to 15 Sec.
Sig Rpt & Roger	R's continuous	S4	16 to 20 Sec.
2 or more R's	Nothing	S5	over 20 Sec.

etc. Therefore, you send complete calls only, until you receive full calls. You send signal report until you receive a signal report and then and only then do you send Rogers. Keep in mind, of course, that you continue sending the signal report until you receive a Roger. If while you are still sending only calls you receive calls and a signal report, you then send only signal report and Rogers. If while you are sending calls and signal report, (which will be only after you have received full calls), you receive a signal report and a Roger, you then send a series of Rogers and nothing else. When you receive 2 Rogers in succession you quit. You've got it made! For this to be absolutely conclusive you must be sure not to send more than one R at a time when you still haven't received a Roger. which of course necessitates that you be sending a signal report along with the Roger.

The signal report can be any arbitrary report, but a system is likewise here suggested. S1 is for a signal burst of not more than 5 seconds, or more than one burst of less than 5 seconds each sufficient to get the full set of calls through. (Again — No signal report is sent until the full set of calls have been received.) S2 for a burst of up to 10 seconds (during which full calls have been received). S3 for a burst of up to 15 seconds, etc. Therefore an S5 would be the highest report you would give indicating a burst of 21 or more seconds. If the burst lasts more than 25 seconds you will probably be using break-in anyway, so you still use S5, or possibly there will be opportunity for use of the complete RST system.

It should be evident from the above that you will never have need to send all 3 items of information together, because if you are in a position to send a Roger, it can only be after you have received a signal report which in itself is indication that your complete set of calls were received at the other end making it unnecessary to send them with the Roger.

The signal report you send will be based on the length of the burst in which you received the complete set of calls, and will not change unless you again receive another full set of calls on a longer burst which still doesn't include a signal report. This is possible because if he is still sending calls without signal reports, it is only because he has not received a signal report from you.

A simple chart is given here which can be cut out or reproduced and displayed at the operating position. Keep in mind three simple rules. Don't send unnecessary information. Don't send more than one Roger in succession until you have received all the information you require. Always be ready to switch to break-in, should the need arise.

As can be evidenced from the chart you can have four separate auto-keying sequences set up ahead of time and will have no need for the hand key unless a chance at break-in avails itself. The one containing solid R's can be used for all MS skeds of course.

SSB for Two

part two

by Russ Miller, W5HCX
Associate Editor
VHF Horizons

The most important step in putting a SSB signal 'on-the-air' is the application of audio to whatever form of balanced modulator we're using. At this point no item should be slighted in order to come up with adequate unwanted sideband suppression and clean audio. The "SSB Rig on Two" is no exception.

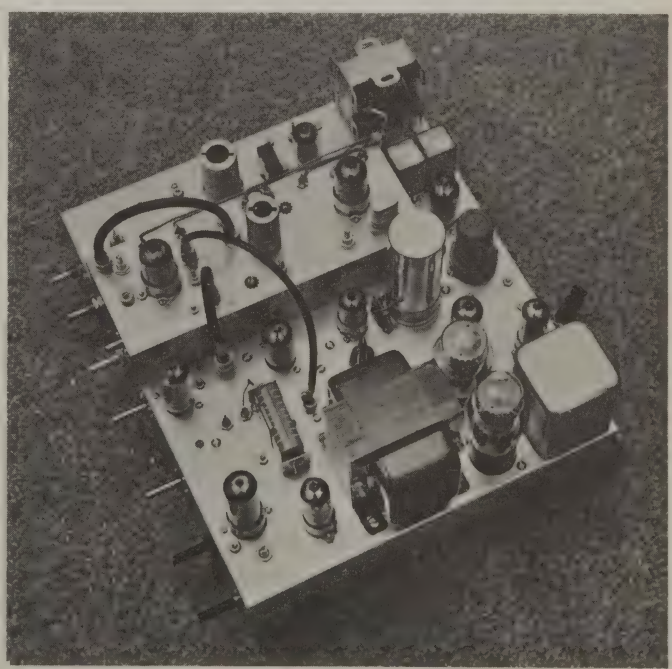
Power supplies are also an important consideration. Important, primarily because if they are not adequately regulated where specified, the result will be a wobbling signal with big chunks of distortion riding on it.

There are many, many ways of cutting corners when building any rig and some are very useful but don't try to cut too many corners. One of the easiest things an amateur can do is to substitute some different tubes than those specified. This idea will probably occur when considering the linear RF amplifiers used in the SSB on Two rig. Don't be tempted. The tubes selected will do the job and last for a long period of time before they start to fall on their nose. Also, if the 5763 is inter-changed with something else, the AM quality will suffer and the RF distortion will go up when the rig is operated in the AM mode. Incidently, the original article last month mentioned using a 12BY7A instead of a 5763. Reason for the change was based on seeking improvement of the AM signal. The 5763 did provide that improvement.

AUDIO SECTION

The 1st audio stage in the rig uses a 12AT7, with both halves operating as straight voltage amplifiers. The second half of the 12AT7, 1st audio stage, is fed to the AM-SSB selector switch. At this point the audio output is fed to either the grid of the 6AQ5 modulator or to the audio phasing network depending on which function is selected.

Selecting SSB connects a small transformer in parallel with the load resistor of



Top-side view of SSB unit. 6360 RF amplifier occupies lower corner of chassis. Battery shown in photo is bias source for the 6360. Average life of battery is two years. Feed-thru capacitor located slightly to the left of the bias battery feed-thru capacitor is meter connection to RF diode. Co-ax plug and jack immediately above feed-thru are used for coupling 2nd mixer output to the RF amplifier input. 16.5 Mc signal is coupled to the sub-chassis by co-ax line shown adjacent to the battery and power transformer. Nylon jack shown on top, front part of sub-chassis, is TP-2.

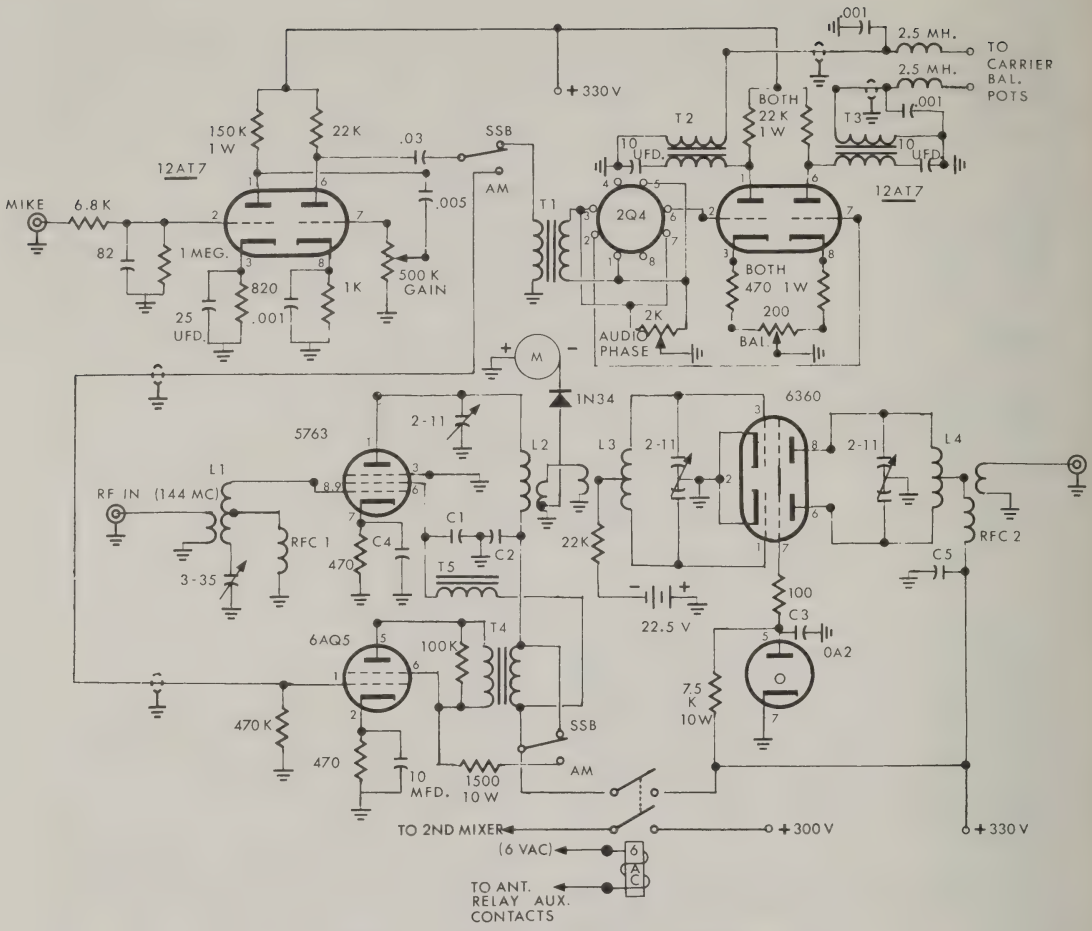


Figure 1. Audio and RF Circuitry, Schematic

the 12AT7. This transformer feeds a B & W 2Q4 audio phase shift network which in turn feeds another 12AT7 audio stage. This 2nd 12AT7 stage is also a straight voltage amplifier. A pair of 20,000 ohm to 600 ohm transformer (W2EWL type) are used as the plate loads for the 12AT7, 2nd audio stage. From here the audio goes through a pair of 2.5 mH RF chokes to the balanced modulators.

AM is a horse of a different color. Back at the 1st audio amplifier stage, 2nd triode section, we feed the audio to the grid of a 6AQ5 through our selector switch. The 6AQ5, operated Class A, is the sole modulator stage. It will provide more than enough audio to modulate the 5763 Class A linear. It might be well to mention at this point that this method of AM is not normally used but it does the job with only a small sacrifice in modulation percentage. I know some amateurs may worry about linearity, varying load conditions, etc. Once again, the rig won't sound like a broadcast station but it will sound clean and do the job.

Gaining a few additional percent improvement in modulation percentage at the expense of a big modulator and the necessity of operating some form of amplifier Class C just isn't worth the cost. There is one thing which is in your favor as far as the modulated stage is concerned, it is highly inefficient. But, it doesn't have to have much output to comfortably drive the following 6360 Class AB1 amplifier.

When considering the microphone types to be used with the SSB on Two rig, don't use a mike with a particularly flat response curve. The high end of the audio spectrum and its rich overtones are best done without. Besides the audio phase shift network is not particularly designed for the range past 3000 cps or below 300 cps. If operation with a carbon mike is desired, ground the grid of the 1st triode section and connect the mike in series with the cathode.

RF AMPLIFIERS

The only tubes used in the RF amplifer section are the 5763 and 6360. The 6360 is

operated as a conventional Class AB1 linear with both its input and output circuits coupled fairly tight to the driving source and load. This is necessary to realize a 2.5 Mc bandpass which is about as much as can be expected without overcoupling and thereby enhancing unwanted harmonics. By properly adjusting this stage, a 3 Mc slice of the 2 meter band can be easily covered in practice.

Like all RF amplifiers, care must be taken to isolate the input and output circuits of the 5763 and the 6360. The only necessary item in either stage is the 100 ohm resistor in series with the 6360 screen grid lead. This resistor should be mounted as close to the socket connection as physical size will allow and also the opposite end should be as close to the .001 stud-mounted capacitor as possible.

If the schematic and the above suggestions are followed, both stages will be stable enough to eliminate the need for neutralization.

The only tuning that is necessary in the RF amplifiers is the grid and plate tuning of the 5763. The 6360 is adjusted only during the initial tune-up of the rig. The absence of any metering in the 6360 stage may lead to some question. The high-power linear that this exciter drives has an RF voltmeter circuit built in to indicate its output. This is used for initial tune-up of the exciter and since the 6360 is fixed-tuned eliminates further need for metering. If bare-foot operation is desired, a 1N34 diode used with a milliameter will suffice to tune up the 6360 stage although some means of monitoring its output is desired. Since the 5763 stage is tuned, a metering provision is necessary. In this case, a 1N82 was tapped up 1/4" from the ground connection provided for the coupling links between the 5763 plate and 6360 grid tanks. The diode (1N82) is then connected to a 500 pfd. feed-thru capacitor. The other end of the feed-thru capacitor is connected to a 0-1 mA. meter.

POWER SUPPLIES

Two power supplies are used for the rig. One supply provides a regulated 210 & 105 VDC and unregulated 250 VDC. This small supply is incorporated on the exciter chassis. It supplies all the stages except for the audio sections and RF linears. The second supply is external and supplies a regulated 300 VDC for the screens of a KW, 4CX250B linear, and an unregulated 350 VDC for the audio sections and low level RF linears. This 350

VDC source is also fed to a 150 VDC regulator on the exciter chassis to provide a regulated voltage for the 6360 screens.

CONTROL CIRCUITS

The actual controls circuits are confined to a single relay. One set of contacts removes the voltage from the 6X8 2nd mixer and the other set of contacts removes the voltage from the 5763. All the oscillator circuits are allowed to operate at all times for maximum stability. There are no birdies in the receiving combination used for the check out of the oscillators, with the oscillators running. However, since the checks were made with a converter using a 30-35 Mc IF this might not be true for those receiving set-ups using a different IF.

Anyways, this problem can be approached a number of ways if you are troubled with annoying birdies from the exciter. One means would be to install another relay to cut off whichever oscillator is interfering. If the birdie is in a portion of the band that is not used, you might just leave it alone. The only other alternative would be to select crystal frequencies that would place the birdies out of the band. If you do have to key one of the oscillator stages, don't be too concerned. In our particular case the International FA series crystals that were used proved extremely stable.

If you are wondering how the control relay is keyed, an extra set of contacts on the external antenna relay does this for us.

LAYOUT

Starting with the audio stages, these were constructed across the back of the chassis. The 2Q4 audio phase shift network is located in the far rear-center of the exciter chassis. To the left is the 12AT7 2nd audio stage. The 6AQ5 is to the right of the 2Q4 and adjacent to the modulation transformer. Directly in front of the modulation transformer is the 210 VDC supply regulators with the 12AT7 1st audio adjacent to the left-hand regulator tube.

The RF amplifiers are located on the front of the chassis and occupy the right hand side. The 150 VDC screen regulator for the 6360 is located behind and to the right of the 6360. A small battery can also be seen on top of the chassis, near the 6360. This is the bias source for the 6360.

The 5763 tuning controls are mounted on either side of the respective tube socket and in a line with the other controls. Since space was needed for the control relay and other components, the audio gain control/on-off switch and the AM-SSB switch were mounted on an aluminum 'L' bracket on the bottom rear of the chassis. This works out very well by eliminating unnecessary long leads between the controls and switches and the audio section.

The audio phasing pot and 2nd audio stage balance pot are mounted across the rear side of the chassis. Also, the AC leads, external power jack, and the microphone jack are located here. Placement of these various parts is not critical although it would be best to keep the audio pots as close to their respective stages as possible.

ADJUSTMENT

RF from the 2nd mixer should be applied to the 5763 and this stage along with the 6360 should be adjusted for maximum output, (full carrier insertion). Next, set the AM-SSB switch for SSB. Apply a 1000 cps audio tone to the grid of the 2nd triode section. With an oscilloscope connected alternately to pins 2 and 7 of the 2nd 12AT7 audio amplifier, adjust the audio phasing pot for a 90 degree phase relationship between these two points. Next, adjust the audio balance pot for equal amplitude output fro this same stage. If an oscilloscope is not available, a suitable receiver may be used for the same purpose. In this case adjust pots for maximum suppression of the unwanted sideband.

After these adjustments have been made, the rig is ready to be put on the air. The only thing that remains is to adjust the mike gain control for the best levels, depending upon which mode of modulation is selected. The RF voltmeter in the exciter RF section will provide a means to monitor the output and assure that either the correct amount of carrier is inserted when operating AM or that the mike gain is set properly when operating SSB.

When using SSB, don't crank the audio up any farther than necessary. If you choose to drive a high-power linear, adjust the audio so you obtain sufficient drive and no more.

When operating AM, you may insert full carrier with one of the carrier balanace pots. There is more than enough audio available to modulate the 5763 so be careful not to turn up the mike gain to the point where distortion is present. The exciter will probably have to be cranked down by adjustment of the carrier balance pots to keep from overdriving a high-power linear amplifier, and consequently, so will the audio gain.

Construction . . . from p. 13

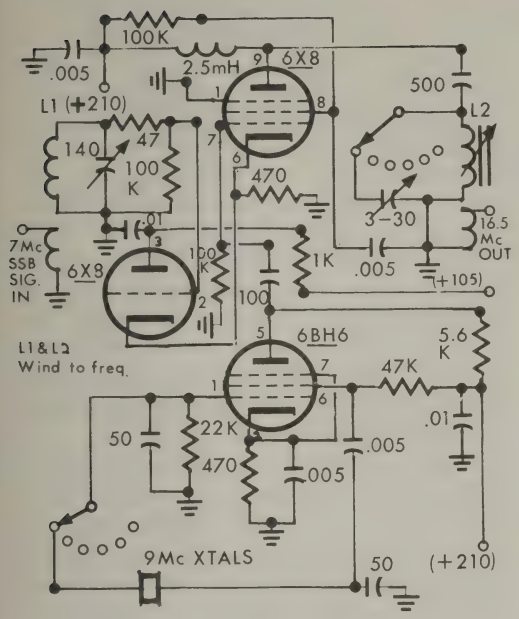


Figure 2. 16.5 Mc Mixer (see part 1)

Operation of the SSB for Two rig is self-explanatory. Changing from AM to SSB or vice-versa, or changing frequencies, is quick and easy. The results you obtain with the rig will be astounding if you have never operated VHF SSB. Better still, tie on a good sized linear. This topic leaves lots of room for thought. Next months issue will contain a full KW linear that can be over-driven by the SSB for Two exciter yet for its power feature occupies a space 12" x 7" x 6". W5HCX

Dear VHF:

Best of luck in your new venture. I particularly appreciated your features by John Chambers and the staff report on "Pi in the Sky". The pi net article was a very clear treatment of common pi net problems.

73
Carl Ebhardt, W4HJZ
22 Rowan Street
Raleigh, N. C.

Carl—

John has quite a bit more to say — and our staff report people are nosing around some more interesting problem areas.

Dear VHF:

I am not at present a VHF bug but the magazine looks so good I had to subscribe (I hope the rest of the issues are just as good). This magazine may make a VHF bug out of me yet!

Edward Nester
2184 Light Street
Bronx 66, N. Y.

Ed—

Welcome aboard — you'll find a lot of fun above 50 Mc! And you can count on the future issues being at least as good as those so far — we're going to try to make them even better.

A good open-wire line can be constructed using No. 12 solid copper wire and 5/16 inch or 3/8 inch diameter polystyrene rod. These sizes afford more strength than 1/4 inch diameter rod. The line is fabricated by stretching two lengths of No. 12 wire tightly between two points in the workshop, making certain they are the proper distance apart (one inch center to center is suitable for 50 and 144 mcs) and parallel the entire length. The wires should be touching the floor.

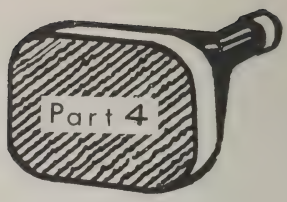
Polystyrene spacers one and one-half inches long (for one inch spaced line) are cut from stock and placed under the tightly stretched wires every six inches. Make certain the spacers are at right angles to the wires. The tip of a hot soldering iron is pressed downward against the wire, and to one side of the polystyrene rod, forcing the wire into the rod. Remove the iron when the wire is completely covered over by the softened polystyrene, taking care not to move the rod or wire until after the polystyrene has hardened. Then perform the same operation on the other end of the spacer. Do not allow the iron tip to touch the polystyrene rod!

A TV type standoff insulator intended for supporting small, tubular 300 ohm line may be used to support open-wire line. At the point of support, the polystyrene spacer should be made longer than normal so that a standoff support may be used at each end rather than one at the middle. This gives better support and minimizes capacity, and possible unbalance, to ground.

Amateurs living in coastal areas or windy locations may find other precautions are necessary. Only a few phases of antenna construction have been covered. Doubtless you have some tricks of your own that make for a better antenna installation. In general, taking a little extra care in the construcion of your VHF antenna and feedline . . . using a little more than the bare minimum . . . protecting against corrosion and moisture . . . will pay off many times. An array that is dependable and does not require frequent repairs is far more useful than a larger one that is out of service much of the time.

For additional information on VHF antennas and construction you are referred to: The A.R.R.L. Antenna Book, The VHF Handbook by Orr and Johnson, and VHF For The Radio Amateur by Frank C. Jones.

TVHFI



by Robert Grimm, K6RNQ
VHF Western Technical Editor

While we are not faced with "odd-ball" cases of TVI everyday, these can be a real headache to track down when they do occur. Some of them can be so far fetched as to make your head spin.

A classic example of this type of TVI oddity was experienced by W6BAZ of Santa Rosa, California a few years ago. Paul had received a report from a TV service organization that he was clobbering Channel No. 5 on a TV set. This TV set happened to be located about 40 miles away from W6BAZ's QTH. To make things even more interesting, there happened to be a 4,000 foot high mountain in between him and the TV set. (Mt. Saint Helena).

Paul dutifully checked his transmitter, but was unable to detect any spurious signals or harmonics that could be causing the trouble. He then communicated with the TV service company that was responsible for maintaining the TV set, and, by working together, they were able to find the cause of the difficulty. What was it? Just an oscillaing mixer tube in the TV set's tuner. Fortunately, it was correctable by replacing the mixer tube. Granted, this was a very unusual case of TVI. The kind of thing you might run into only once in a lifetime. But it's a prime example of the many "oddball" types of interference that do occur. These are the things that make many hams permaturely gray!

Not quite so unusual was a situation I experiencd a few months ago. Some people from down the street called and informed me they were receiving interference on Channel No. 2 and they thought it might be caused by me. (In fact they were pretty doggone sure it was).

Not being on the air at the time, I knew it couldn't be me. But being a good neighbor, I took a stroll over to their house to see what the trouble might be. Sure enough, there was a big black herringbone pattern wandering up and down the screen. It was doing a thorough job of obliterating Channel No. 2 although the other channels were not affected.

Playing a hunch, I turned off the TV viewing lamp that was setting on top of the set. The interference immediately disappeared. Turning the light back on caused the interference to reappear.

The interference was eliminated by the simple expedient of replacing the bulb in the lamp. Why was the bulb radiating this signal?. Don't ask me! I had run into this situation several times in the past, when I was doing TV service work. It could always be remedied by replacing the bulb. (Provided, of course, that it was being caused by the bulb).

While we are in the light bulb department, a real hash generator is the old carbon arc bulb. These things are a holdover from the twenties and are occasionally found in porch lights on older houses. The hash they generate is not far removed from what you would expect from a spark-gap transmitter and they louse things up just about as well, too! They should be replaced with modern bulbs.

Getting back to the TV viewing lamp: An important thing to remember is to *not* rub it into the people who complained. They are going to be very embarrassed when they find out they were the cause of their own TVI and had blamed it on you.

They will want to make up for having wronged you and, if handled properly, can become neighborhood boosters for you. Be sure to tell them that "this is just one of those things that happen and don't feel bad about it."

"SINGING BATHTUBS"

You have probably heard of incidents where people have heard music insuing from their dental fillings, from pipes in the basement or coming out of their bathtub. These are not "Old Wives Tales". They really do happen. These incidents generally occur in the immediate vicinity of high powered AM broadcast stations.

While it isn't likely that your neighbors will copy you loud and clear on their dentures, the causes of these strange phenomena are closely related to the causes of many unusual types of TVI, *i.e.*: rectification. This can be caused by a rusty joint in a waterline, two pipes of dissimilar metal resting against each other, loose or corroded connections in the TV antenna system, on telephone lines (call the telephone company if you think a corroded joint in their lines is causing the trouble — never touch the telephone lines yourself!), or a loose or corroded connection *in your antenna system!*

If you stop and think about it, there is really no great mystery why corroded or rusty connections cause TVI. Another name for rust is oxidation. An oxide can be a very good rectifier; you've undoubtedly heard of copper oxide rectifiers.

Well, when this recitifier detects your signal many harmonics are generated and if one of these harmonies happens to fall into a TV channel . . . TVI!

If your neighborhood is like most American neighborhoods, you probably have your local HiFi addict who manages to pick you up on his TV set, hifi amplifier, tape recorder and radio, what with his audio leads strung all over the house. (These leads sometimes make such excellent 50 Mc antennae, that I've often considered discarding my beam and using them.)

It's amazing how much signal these audio leads pick up and pipe directly into the TV receiver and audio amplifiers. About the only way to handle these types of cases is to temporarily disconnect the leads and demonstrate how much interference they are picking up. If he refuses to shorten the leads or to cooperate in the usual methods of curing audio rectification (as discussed in a preceeding chapter) his refusal should be communicated to the local field engineer's office of the FCC.

Obviously, if he won't coooperate, there is nothing you can do for him. Actually, the vast majority of people are quite co-operative in these cases; the above was mentioned only so that you will know what to do when you run into someone who refuses to cooperate in having the TVI cleared up.

Next month we will discuss the proper methods of shielding and cleaning up your transmitter. 'Til then, lots of luck on your WAC (worked all channels).

CLASSIFIED

Commercial classified advertising space is available at 25 cents per word, per month. Minimum number of words per advertisement, 10. Classified advertising submitted by individual hams which in the opinion of VHF Horizons is non-commercial in nature, 10 cents per word, no minimum. Full remittance must accompany all orders; closing date for each issue is the 5th of the preceding month. Copy must reach Oklahoma City by that time.

LIKE NEW SX-101A, $295. K9IEB, 31 Ridge Avenue, Evanston, Illinois.

HEATH SHAWNEE 6 mtr. transceiver in top shape with Ameco preamp, $225. Write: K9YCA, 107 N. 26th, South Bend, Indiana.

WANTED: tropo skeds with Kansas on 50 Mc. Saturday evenings or early Sunday mornings. CW or SSB, 50.012 and 50.112; CW, 144.012. Have kilowatt, suitable antenna, passable receiving set-up . . . will listen for you. W5KHT, P. O. Box 1557, Oklahoma City 1, Okla.

SURPLUS goodies stacking up on you? Send us an ad on them and watch them go. One fellow got cleaned out on 832A's—by a retail house yet! What have you got to sell?

VHF Lab Reports

A 38 element yagi antenna on any band below 144 megacycles would be a physical impossibility. On two meters it just barely gets inside the realm of credibility.

Telrex Labs, Inc., Asbury Park, N. J. has such an antenna. And just to make the array even more fascinating, they have allowed someone to talk them into twisting it from length to length (43 feet from tip to tip) in a not so common Spiral-Ray fashion.

The end result is a two meter yagi that demands the very best patience and equipment the typical two meter enthusiast can muster, if the array is to perform properly. However, if you are as much an engineer as you think you are, assembly, erection and tuning of this monster should occupy no more than a typical sun-up Saturday to sun-down Sunday weekend. It did us.

Everything comes from the packing carton. In abundant handfuls, we might add. The 43-foot boom is broken down into three sections of tubing. Starting from the rear, the reflector, driven element and first 8 directors mount on a single piece of 2 inch OD tubing. Next in line, the middle piece. It holds the next 19 directors. Last in line, the final boom section. It suspends directors numbered 28 to 36.

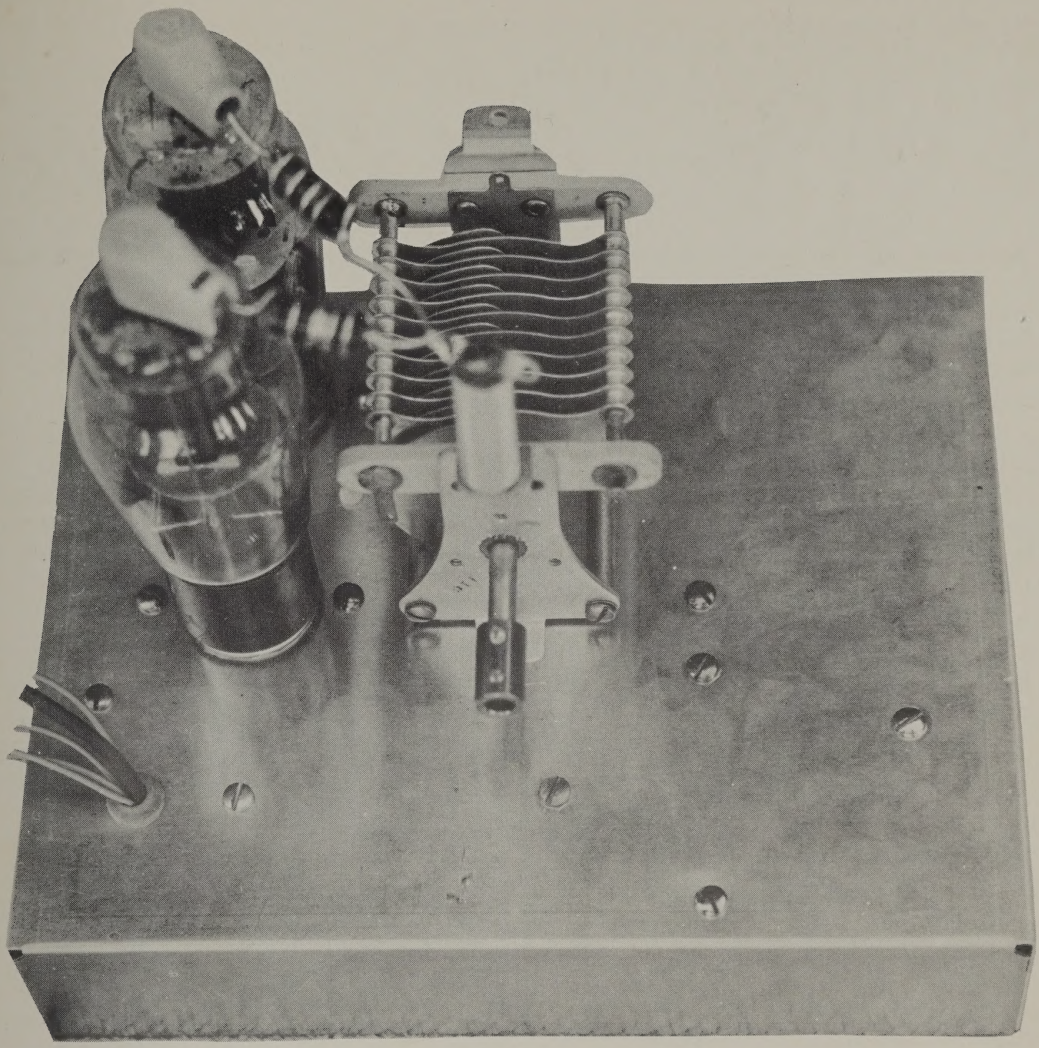
Like all good Telrex beams, this antenna is rugged and well designed. The fact that all of the 80 odd holes line up is a tribute to somebody at Telrex. We can't imagine any amateur tackling the project with a hand drill and vise.

As it arrives, the beam is tuned for 144.5 megacycles. As Telrex notes, you can move it up a megacycle at a time by whacking 1/4 inch off the overall length of each element (they vary from 42 inches long for the reflector to 30 inches long for the 36th director). From a practical standjoint, we would have liked Telrex to start off with the antenna resonant at 144.000 megacycles and then let us whack off the 1/4 inch pieces. We feel that those characters who are going to invest in this antenna are going to be DX nuts concentrating on the low edge of the band.

Once assembled (a project roughly equivalent to building the Empire State Building from an erector set) the antenna really begins to impress you. For example you try to lift it, by firmly grasping the boom in the middle and giving a heave-ho. If you have recently devoured a bowl of Wheaties the antenna slowly rises from the saw-horses you assembled it on, "twangs" on each end and then goes into wild oscillations from its 30 inch director, to the other end and its 42 inch reflector. You move quickly to get it above your head because the spiral elements are dancing dangerously close to your windpipe, and you never were much of a CW man.

Finished with the erection and mounting you dash to the receiver and listen for the S9 signals you expect to hear from KH6UK. The band is quiet. You casually observe the beam is pointed to the northwest — a direction in which you have not heard a 144 megacycle station in the past six months. Bringing the big array around to the northeast you find a number of carriers in the lower megacycle running 6-15 db above the noise on your 7788 converter. All W0's.

Advice? Comments? Keep this yagi mounted on a tower all by itself. Other antennas within 43 feet of it on the same tower throw it into *pattern fits*. It is even advisable to break up the antenna horizon around your QTH by keeping other antennas at least 1/2 boom length out of its plane (*i.e.* none between 39 feet above ground and 81 feet above ground) This is not an antenna for the casual operator. It is for the dead serious two meter addict who wants his cake, and wishes to eat it too. The 2MSR-3843 is truly a two-beam spotlight . . . one in the vertical plane and one in the horiznotal.. And dead in the center of the "spot" is two meter DX. Lots of it.



What is it ?

Yeah — what is this gadget? At this point, it could be almost anything. So to end the suspense, we'll tell you. This is the "Lazy Linear" which will be one of our November features, as seen in an early stage of construction. Using a couple of vintage 807's and a handful of other parts from the junk box, this device is designed to boost the output power of the popular Heath Sixer to more-respectable levels. We've measured better than 20 watts from a Sixer-linear combination here — and the same amplifier, driven with a fleapower SSB exciter, gives more than 100 watts! This is just one of the many features coming your way in November and following issues of VHF — one of the five

VHF HORIZONS
P. O. BOX 1557
OKLAHOMA CITY, OKLAHOMA

WELL?